DOCUMENT RESUME

ED 256 961 CE 041 566

TITLE	Specific Technological Assumptions Affecting the Bureau of Labor Statistics' 1995 Employment Projections. Report to the Honorable Berkeley Bedell, United States House of Representatives.
INSTITUTION	General Accounting Office, Washington, D.C.
REPORT NO	GAO/OCE-85-2
PUB DATE	20 May 85
NOTE	142p.; For a related document, see CE 041 409.
AVAILABLE FROM	U.S. General Accounting Office Document Handling and Information Services Facility, P. O. Box 6015, Gaithersburg, MD 20877 (First five free; additional copies: $3.25 bound, $1.00 unbound).
PUB TYPE	Reports - Research/Technical (143)
EDRS PRICE	MF01/PC06 Plus Postage.
DESCRIPTORS	Career Education; *Demand Occupations; *Employment Patterns; *Employment Potential; *Employment Projections; Futures (of Society); *Resource Materials
IDENTIFIERS	*Bureau of Labor Statistics

ABSTRACT

This report begins with a brief description of the process that the Bureau of Labor Statistics (BLS) uses to develop its employment projections. It then provides detailed information on specific technological assumptions that BLS used in projecting 1995 employment levels for certain industries and occupations. Information is also included on the actual and projected employment levels for these industries and occupations, as well as a discussion and summary of the documents that BLS maintains to develop its assumptions and employment projections. Eight enclosures amount to 125 pages. Enclosure I contains assumptions regarding the 59 durable goods industries as defined by BLS. General and technological assumptions as well as rates of development and dispersal are provided. Similar information is contained in enclosure II, consisting of assumptions regarding the 40 highest growth occupations as defined by BLS. Information for each of the 59 durable goods industries and each of the 40 largest growth occupations contained in enclosures III and IV shows 1982 actual employment, 1995 projected employment, the differences between 1982 actual and 1995 projected employment levels, and percentage of change. Enclosures V and VI offer categorizations of documents retained by BLS for the durable goods industries and for the 40 largest growth occupations. Enclosures VII and VIII contain correspondence. (YLB)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED256961

BY THE U.S. GENERAL ACCOUNTING OFFICE

Report To The Honorable Berkley Bedell United States House Of Representatives

Specific Technological Assumptions Affecting The Bureau Of Labor Statistics' 1995 Employment Projections

Every 2 years the Bureau of Labor Statistics (BLS) prepares and reports projections of future employment by occupation and by industry.

This report lists specific technological assumptions BLS used in projecting 1995 employment levels.

A companion report (GAO/OCE-85-1) examines the process that BLS uses to generate its employment projections and analyzes the major factors affecting these projections.

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☐ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

OCE-85-2

GAO/OCE-85-2
MAY 20, 1985

Request for copies of GAO reports should be sent to:

U.S. General Accounting Office
Document Handling and Information
Services Facility
P.O. Box 6015
Gaithersburg, Md. 20877

Telephone (202) 275-6241

The first five copies of individual reports are free of charge. Additional copies of bound audit reports are $3.25 each. Additional copies of unbound report (i.e., letter reports) and most other publications are $1.00 each. There will be a 25% discount on all orders for 100 or more copies mailed to a single address. Sales orders must be prepaid on a cash, check, or money order basis. Check should be made out to the "Superintendent of Documents".

UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

OFFICE OF THE CHIEF ECONOMIST

B-217084

The Honorable Berkley Bedell
House of Representatives

Dear Mr. Bedell:

Subject: Specific Technological Assumptions Affecting the Bureau of Labor Statistics' 1995 Employment Projections (GAO/OCE-85-2)

As the Chairman, Subcommittee on General Oversight and the Economy, Committee on Small Business, you requested that the General Accounting Office examine certain issues concerning projections of future employment levels made by the Bureau of Labor Statistics (BLS)[1]. In subsequent discussions with your office, it was agreed that we would issue two reports in response to your request. One report would focus on the process BLS uses to project future employment levels; the other report would describe in detail specific technological assumptions that BLS used in projecting 1995 employment levels for certain industries and occupations.

This second report contains a brief description of the process that BLS uses to develop its employment projections. It also contains detailed information on specific technological assumptions affecting the 1995 employment projections for those industries and occupations that you requested we examine. In addition, we have included information on the actual and projected employment levels for these industries and occupations, as well as a discussion and summary of the documents that BLS maintains to develop its assumptions and employment projections. A companion report (GAO/OCE-85-1) discusses the BLS employment projection process in greater detail and analyzes the relative effects that certain determinants have on BLS' employment projections.

---

[1]The Bureau of Labor Statistics is responsible for the Department of Labor's economic and statistical research activities. As the federal government's principal data-gathering agency in the field of labor economics, BLS collects, processes, analyzes and disseminates data on employment, unemployment, wages, productivity and technological change.

BLS makes long-term employment projections on a 2-year cycle. In 1982, BLS made industry and occupational employment projections for 1995 using a variety of assumptions. These assumptions can influence adjustments that BLS makes in the process of generating its official employment projections. Some of these assumptions apply to all industries, while others are specific to individual industries or occupations. Some are technology-related assumptions (e.g., there will be an increased use of computer-aided design and computer-assisted manufacturing in the ordnance industry), while others are general assumptions not related to some form of technology (e.g., the number of armed forces personnel will not change, and there will be no major war by 1995). For specific technology-related assumptions, we asked BLS about the anticipated rates of development (how quickly a specific technology moves from the "drawing board" or prototype stage to commercial use) and the anticipated rates of dispersal (how quickly the developed technology will be disseminated throughout an industry or occupation) used in making its employment projections.

For the 59 durable goods industries[2] that you requested we examine, BLS reported a total of 378 specific assumptions. Of these assumptions, 178 were general assumptions and 152 were technological assumptions. There were also 8 assumptions concerning anticipated rates of development and 40 assumptions concerning anticipated rates of dispersal of new technologies. The specific assumptions for each of the 59 durable goods industries are contained in Enclosure I.

For the 40 occupations that you requested we examine, BLS reported a total of 196 specific assumptions. Of these assumptions, 99 were general assumptions and 67 were technological assumptions. There were also 12 assumptions concerning anticipated rates of development and 18 assumptions concerning anticipated rates of dispersal of new technologies. The specific assumptions for each of the 40 occupations are contained in Enclosure II.

During our review, we found that BLS maintains an extensive amount of resource information to develop these assumptions. However, because of the process that BLS uses to generate its employment projections, it is not possible to determine what the quantitative effect of any specific assumption is on BLS' final employment projections.

---

[2]The U.S. Department of Commerce's Dictionary of Economic and Statistical Terms (1972) defines durable goods as items with a normal life expectancy of 3 or more years, such as automobiles, furniture, and household appliances.

OBJECTIVE, SCOPE AND METHODOLOGY

Our objective was to identify specific assumptions concerning technological change, rates of development, and rates of dispersal that BLS used in the process of generating its 1995 employment projections. As you requested, we gathered this information for the 59 durable goods industries and the 40 occupations expected to provide the largest number of new jobs between 1982 and 1995. BLS refers to these occupations as the "40 occupations with largest job growth."

For each of these industries and occupations, we asked BLS the following questions:

1. What were the assumptions used in making the 1995 employment projections, including any assumptions made concerning technology?

2. Of the assumptions identified, which were assumed to involve technological changes or developments that would affect employment in the industry or occupation in 1995?

3. What were the assumptions for determining how quickly the changes or developments would be implemented or available for implementation in the industry or occupation in 1995?

The assumptions BLS provided us in response to these questions focus only on the direct effects of technological change on the projected employment levels for these industries and occupations. Because there are a number of ways in which technological considerations can indirectly affect BLS' employment projections, these assumptions do not encompass all of the effects of technological change on BLS' projected employment levels for these industries and occupations.

We did not attempt to analyze the validity of the assumptions BLS provided us, nor did we attempt to draw any conclusions about, or make recommendations to change, the process BLS uses to make its employment projections. The assumptions that BLS provided us with were those used in 1982, and are based primarily on the recollections of the BLS staff we interviewed.

To determine the assumptions and background research used in making the 1995 projections, we interviewed the Associate Commissioner of BLS' Office of Economic Growth and Employment Projections, division chiefs, and BLS analysts. Most of our interviews were with officials responsible for the employment projections system, specifically, with those officials responsible for the industry labor demand and occupational labor demand models. We also interviewed officials in BLS' Office of Productivity and Technology, to obtain information on their reports on technological change.

We reviewed the support documents provided by BLS and verified their relevance to the specific industries and occupations for which they were used in making assumptions and projections. We did not, however, relate the existing BLS documentation to each of the specific assumptions made in formulating the projections.

To understand how the assumptions affect the final employment projections, we needed to understand first the process BLS uses to generate these employment projections. Because this process is discussed in detail in a companion report (GAO/OCE-85-1), it is only briefly described in this report.

Our review was performed from October 1983 through October 1984 in accordance with generally accepted government audit standards.

THE BLS EMPLOYMENT PROJECTION PROCESS

The process that BLS uses to generate its employment projections is based on a system of five interdependent economic models:

1. A labor force model used to project the future size of the labor force.

2. A macroeconomic model used to project such variables as aggregate unemployment, inflation, and the level and composition of gross national product (GNP).

3. An industry activity model used to project future output levels on an industry-by-industry basis.

4. An industry labor demand model used to project each industry's future employment level.

5. An occupational labor demand model used to project each occupation's future employment level.

The specific steps in the BLS projection process, the inter-relationships among each of these models, and their respective data requirements, are discussed in detail in our companion report. However, it is important to emphasize, for the purposes of this report, two aspects of the BLS employment projection process.

First, during the course of the process, BLS makes subjective adjustments to the parameters of these models and resulting projections to incorporate, if deemed appropriate, knowledge that BLS analysts have acquired about technology, productivity, and other trends that might affect certain industries and occupations. For example, adjustments to the input-output coefficients contained in the industry activity model are made to account for the effects of expected technological developments. Adjustments to the projections of the industry labor demand model are made by BLS analysts based on their judgment and working knowledge of particular industries. Similarly, the staffing pattern ratios contained in the occupational labor demand model are reviewed and adjusted by BLS to account for changes in technology, production, or other factors that are expected, or assumed, to occur in the future. It is those specific assumptions affecting the projections of the industry labor demand model and the occupational labor demand model that we asked BLS to provide to us.

Second, because of the inter-relationships among the models, BLS also performs a number of iterations during the process to ensure that the results of the models are internally consistent. Such consistency checks are performed after any particular set of adjustments has been made. These iterative procedures generally result in each model being "run" several times. For example, BLS said that approximately 60 to 70 computer runs of the labor demand model existed between the initial set of 1995 employment projections and the final set of projections published in the November 1983 issue of the Monthly Labor Review.

RELATIONSHIP OF SPECIFIC TECHNOLOGICAL ASSUMPTIONS TO EMPLOYMENT PROJECTIONS

In interviews with BLS staff, we were told that, where specific assumptions have been made regarding technological change, the projected employment growth rates will usually differ from the trend rates (straight-line extrapolations of past employment growth rates). However, even in industries where it was assumed that no technological change would occur, the projected rates of employment growth are not necessarily equal to the trend rates for those particular industries.

We were also told that, although the industry labor demand model incorporates consideration of technological changes, no attempt is made to quantify the precise effect of each new technology. Therefore, while BLS analysts make assumptions

about new technologies, it is not possible to relate a specific quantitative adjustment in the employment projections to any specific technological assumption.

THE DURABLE GOODS INDUSTRIES

BLS projections for employment from 1982 to 1995 in the 59 durable goods industries range from about a 27-percent decrease in the "wooden containers" industry to about a 72-percent increase in the "medical and dental equipment instruments" industry. Most of the 59 industries show an increase in employment, with "computers and peripheral equipment," and "medical and dental instruments" projected to have the greatest percentage increases. However, three industries, "wooden containers," "structural clay products," and "metal containers," are projected to experience a decrease in employment of about 27-percent, 12-percent, and 3-percent, respectively.

The following table summarizes the projected changes in employment from 1982 to 1995 for 58 of the 59 durable goods industries. One industry was projected to have no change during the period.

Percent Change In Employment	Number of Industries	
	Increase	Decrease
25 or less	24	2
26 to 50	27	1
51 to 75	4	0
Total	55	3

Information for each of the 59 durable goods industries, showing 1982 actual employment, 1995 projected employment, the differences between the 1982 actual and 1995 projected employment levels, and percent changes is contained in Enclosure III.

Specific Assumptions Expected to Affect the Durable Goods Industries

The assumptions used by BLS, and provided to us, for the 59 durable goods industries are listed in Enclosure I. The following table shows the total number of assumptions BLS provided to us and the number of durable goods industries for which each type of assumption was made.

Type of Assumption	Number of Assumptions	Industries Represented
General	178	59
Technological	152	59
Rate of Development	8	8
Rate of Dispersal	40	28
Total	378	

The next table shows the number of durable goods industries for which a given number of specific assumptions were made.

Number of Assumptions	General	Techno-logical	Rate of Development	Rate of Dispersal
0	0	0	51	31
1	16	18	8	22
2	17	16	0	2
3	17	12	0	3
4	7	6	0	0
5 or more	8	7	0	1
Total	59	59	59	59

A BLS group leader told us that, because BLS focuses primarily on productivity, the agency does not spend as much time examining the rate of introduction of a new technology as it does on the ultimate level of output and related employment for the target projection year. Also, these specific assumptions focus only on the direct effects of expected technological developments on these industries and, thus, do not encompass all of the technological considerations affecting BLS' employment projections. For example, as discussed in our companion report (OCE-85-1), BLS' industry labor demand functions include a variable designed to capture the employment effects of general technological change.

THE 40 OCCUPATIONS WITH THE LARGEST JOB GROWTH

BLS projections for employment in the 40 occupations with the largest projected job growth from 1982 to 1995 range from an increase of about 16 percent for typists to about 85 percent for computer systems analysts.

The following table summarizes the projected changes in employment from 1982 to 1995 for these 40 occupations.

Percent Increase In Employment	Number of Occupations
25 or less	5
26 to 50	30
51 to 75	2
over 75	3
Total	40

Information for each of the 40 occupations, showing 1982 actual employment, 1995 projected employment, the differences between the 1982 actual and 1995 projected employment levels, and percent changes is contained in Enclosure IV.

Specific Assumptions Expected to Affect the 40 Occupations with Largest Job Growth

The specific assumptions used by BLS, and provided to us, for the 40 occupations with the largest projected job growth are contained in Enclosure II. The BLS analysts we interviewed grouped some of these occupations together and gave the same set of assumptions for all of the occupations within a group. The BLS analysts said that they made a general assumption that employment in each of the 40 occupations is contingent on the projected growth of those industries employing those occupations. This is because the occupational labor demand projections are based on the industry labor demand projections.

Additionally, BLS analysts said that they often made the assumption that technology would not have any significant effect on employment in a given occupation by 1995. In some cases where it seemed likely that technology could have a significant effect, the analysts explained that there were offsetting factors which they believe would negate the effect on employment. For example, they believe that the increased demand for electricians due to the increased demand for electrical and electronic equipment will be offset by the fact that the equipment will be easier to install and maintain. Therefore, the demand for electricians will not increase proportionately to the demand for electrical and electronic equipment.

The following table shows the total number of specific assumptions BLS provided and the number of occupations for which each type of assumption was made.

Type of Assumption	Number of Assumptions	Occupations Represented
General	99	40
Technological	57	40
Rate of Development	12	12
Rate of Dispersal	18	11
Total	196	

The next table shows the number of occupations for which a given number of assumptions were made.

Number of Assumptions	General	Techno-logical	Rate of Development	Rate of Dispersal
0	0	0	28	29
1	9	26	12	4
2	18	7	0	7
3	6	2	0	0
4	1	4	0	0
5 or more	6	1	0	0
Total	40	40	40	40

Regarding assumptions for the rates of development and dispersal, the BLS analysts we interviewed most often described the new technologies they identified as being "gradually developed" and "gradually dispersed." Therefore, new technologies often were not considered as having a significant effect on the employment projections for the 40 occupations. As in the case of the durable goods industries, these assumptions focus only on the direct effects of technological change on specific occupations. Thus, they do not account for the other ways that technological change affects BLS' occupational employment projections.

RESOURCE INFORMATION BLS MAINTAINS ON INDUSTRIES AND OCCUPATIONS

Both internally and externally produced materials are used as resource information and background for making assumptions affecting BLS' employment projections, according to the BLS analysts responsible for making these projections.

BLS analysts in the Office of Economic Growth and Employment Projections relied primarily on four types of documents: their own special industry studies, industry studies developed by BLS' Office of Productivity and Technology, external documents, and their own technical memoranda on occupations.

Special Industry Studies

BLS' Office of Economic Growth and Employment Projections completed and used special industry studies on 29 industries. These studies, which are used to assess the impact of changing technology on occupational structures, generally encompass:

- a statement of the general economic trends or conditions affecting the industry,
- an analysis of the industry's input-output relationships,
- an analysis of the industry's employment projections,
- an analysis of historic occupational staffing patterns, and
- a list of primary sources used in preparing the study.

These special studies are used to make judgments concerning changes in input-output coefficients, final demand projections, and industry and productivity projections when making both industry and occupation employment projections.

Industry Studies Focusing on Technological Change

According to BLS analysts, BLS' Office of Productivity and Technology develops studies of technological change on selected industries which are also used by BLS' Office of Economic Growth and Employment Projections. These studies are primarily productivity analyses focusing on labor implications and the employment outlook over the next 5 to 10 years in certain industries. The industries studied are selected on the basis of five criteria:

- the industry must be considered important in terms of employment,
- productivity information on the industry must be available,

- technological innovations have to be occurring and be at a stage of commercial application,
- there has to be cooperation from the industry, and
- the industry should represent a major group in the economy.

Eleven studies on the durable goods industries were made from 1974 to 1982 and were used as a source of background information for making specific assumptions.

External Documents

BLS analysts also use external sources for research prior to making assumptions and projections. For the durable goods industries, they used studies produced by other government agencies and universities. For example, the analysts used the "Department of Commerce 1983 U.S. Industrial Outlook" and Carnegie Mellon University's study, "Preparing for the Growth of Industrial Robots" (1981). In addition to these studies, the analysts said they regularly read various periodicals and trade journals for background information.

The table below lists the number of durable goods industries for which each type of document was identified as being used by BLS.

Type of Document	Number of Industries
Special Studies	14
Studies of Technological Change	11
Other Studies	9

In addition, the BLS analysts used as background for all the industries a book entitled "The Future With Microelectronics, Forecasting the Effects of Information Technology," prepared by the University of Sussex.

BLS analysts also maintain extensive, external documentation on most of the occupations we reviewed. The documentation for each occupation usually included articles from newspapers and trade journals, statistical data from various sources, and other information specific to the occupation. Of the 40 occupations with the largest projected job growth, these documents were retained for the 33 occupations included in the 1984-85 edition of BLS' Occupational Outlook Handbook.

Technical Memoranda

Technical memoranda are research documents written by staff in BLS' Office of Economic Growth and Employment Projections on selected occupations. These memoranda are used by the analysts as background for making occupational employment projections. Technical memoranda generally include:

- o statistical data,
- o memos of interviews with employers, related associations or unions,
- o data on employment outlook, future earnings, supply, and replacement needs,
- o titles of periodicals,
- o names of reviewers (usually the same individuals who are interviewed) and organizations, and
- o recommendations (if any) regarding the occupation for future inclusion in BLS' Handbook

A technical memorandum is written on an occupation if it is to be included in the Handbook. Of the 40 occupations with the largest projected job growth, technical memoranda, including memos of interviews, were written on the 33 occupations included in the 1984-85 edition of the Handbook.

AGENCY COMMENTS

We requested and received written comments on a draft of this report from the Bureau of Labor Statistics. In these written comments, which are attached as Enclosure VII, BLS expressed concern that our draft report could lead to several misimpressions. First, BLS was concerned that the draft report, by focusing exclusively on industry-specific and occupation-specific assumptions about technological change, might give the misimpression that such assumptions encompass all of the technological considerations that affected these employment projections. Second, BLS was concerned that the draft report might create the misimpression that BLS is casual in making changes in the values of certain variables affecting the employment projections. Third, BLS was concerned that another misimpression could arise from the way we characterized BLS' responses to our questions about the rates of development and dispersal of technologies. We revised our report to avoid any of these incorrect impressions.

BLS also pointed out that, for some industries, two technological assumptions about the use of computer-assisted design and computer-assisted manufacturing and electronics seemingly contradicted other specific assumptions about future technological change. We revised our report to correct any inconsistencies.

* * * * *

We hope that the information conveyed in this report is helpful in understanding the specific technological assumptions that BLS used in generating its 1995 industry and occupational employment projections. As arranged with your office, copies of this report will be sent to interested parties and will be made available to others upon request. If we can be of further assistance, please do not hesitate to contact us.

Sincerely,

Lawrence H. Thompson

Lawrence H. Thompson
Chief Economist

Enclosures - 8

Contents

ENCLOSURE		Page
I	Assumptions Regarding the Durable Goods Industries as Defined by BLS	1
II	Assumptions Regarding the 40 Highest Growth Occupations as Defined by BLS	75
III	BLS Projected Employment in the Durable Goods Industries	106
IV	BLS Projected Employment in the 40 Largest Growth Occupations Between 1982 and 1995	111
V	Categorization of Documents Retained by BLS for the Durable Goods Industries	114
VI	Categorization of Documents Retained by BLS for the 40 Largest Growth Occupations	119
VII	Comments from the Bureau of Labor Statistics	122
VIII	Letter dated December 16, 1983, from the chairman, Subcommittee on General Oversight and the Economy, Committee on Small Business, U.S. House of Representatives	125

ASSUMPTIONS REGARDING THE DURABLE GOODS INDUSTRIES AS DEFINED BY BLS

ORDNANCE

Description

Produces artillery, artillery components, small arms and accessories, ammunition, tanks and tank components.

The output is consumed by the federal government, in particular, the Department of Defense; by individuals; and is exported.

Assumptions

General

1. The Department of Defense will purchase 53 percent of this industry's output.

2. The number of personnel in the armed forces will not change and there will be no major war by 1995. However, the armed forces will use more materials (industry products) and more expensive ones in 1995. With no increase in personnel costs all real increases in defense purchases will be for weapon procurement.

3. The quality of the weapons and ammunition will improve by 1995.

4. Exports will be 13-percent of total output by 1995.

5. Imports will decline to 2 percent of all output by 1995.

6. Output of this industry will have an average annual growth rate of 3.3 percent from 1977 to 1995.

7. Personal consumption expenditures for this industry will remain unchanged as a share of output.

Technological

1. There will be increased use of electronics in this industry by 1995, with the use of "smarter" tanks and heat-seeking missiles.

2. There will be some new developments in this industry; however, no specific technologies were identified.

3. There will be increased use of computer-aided design and computer-assisted manufacturing (CAD/CAM).

4. Past trends in quality of artillery and missiles technology will continue to 1995.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. No rate of dispersal was provided.

ENCLOSURE I

COMPLETE GUIDED MISSILES AND SPACE VEHICLES

Description

Researches and produces completely assembled ballistic and guided missiles, rockets, and space vehicles.

The output is consumed by the federal government, primarily by the Department of Defense and the National Aeronautics and Space Administration (NASA).

Assumptions

General

1. The industry will continue to be driven by defense purchases, which will account for 75 percent of the industry's output by 1995. Of the remaining 25 percent of the output, 20 percent will be purchased by NASA and 2 percent will be exported.

2. This industry will grow faster than total defense purchases. With no growth in troop strength 1982-95, increased real defense purchases will be for material.

3. Nondefense purchases in real terms (e.g., by NASA) of guided missiles by 1995 will be lower than in 1972 and 1977, due to less activity in the space program.

4. This industry will buy more materials from the aircraft industry for use in the production process than it will produce itself to use in the production process.

Technological

1. There will be use of CAD/CAM by 1995.

2. There will be use of robots by 1995.

3. There will be use of composite materials by 1995.

4. There will be more use of electronic components by 1995.

5. There will be use of improved radio and communication equipment by 1995.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. No rate of dispersal was provided.

LOGGING; SAWMILLS AND PLANING MILLS

Description

The logging industry cuts timber and produces rough, round, or hewn primary forest or raw wood materials.

The sawmills and planing mills industry produces rough surfaced lumber from logs and bolts, and produces laths, railroad ties, hardwood flooring, shingles, and related wood specialties.

The output of these industries is consumed as an input to the wood industries. In addition, the output from the logging industry is consumed as an input to the paperboard processing industry. The output from the sawmills and planing mills industry is consumed as an input to the construction industry.

Assumptions

General

1. Much of the output from these industries and demand for their products is related to the construction industry.

2. There will be a switch from single-family homes to multifamily homes. The single-family homes that will be built will be smaller, thereby requiring less lumber. In addition, multifamily homes will not require as much lumber, since more masonary than lumber will be used. The result of these trends is to somewhat offset the large demand for lumber expected from high levels of new construction.

3. Exports will continue at a healthy level. Japan, which takes most of the lumber from the United States' west coast, will continue to do so.

Technological

1. No new product or systems technologies in sight.

Rate of Development

1. Not applicable.

Rate of Dispersal

1. Not applicable.

OTHER MILLWORK, PLYWOOD AND WOOD PRODUCTS

Description

Produces fabricated millwork, veneer, plywood paneling, and prefabricated wooden buildings and structural members; and treats wood(s) for preservation.

The output is consumed as an input to residential construction and to wood processing industries.

Assumptions

General

1. Products from this industry are used by new construction and maintenance construction (do-it-yourself). This industry is not tied to the new construction industry as much as the logging and sawmill industries because there are more final demand purchases for maintenance construction and for personal consumption expenditures.

2. This is a demand-driven industry in which the demand increases will be dampened somewhat as a result of switching from single-family homes to multifamily homes. Single-family homes are assumed to be smaller, thereby requiring less lumber. Multifamily homes are not requiring as much lumber due to switching to masonry.

Technological

1. Plywood being replaced by oriented strandboard and waferboard where glass and synthetic fibers are used as reinforcement. Waferboard uses scrapwood and the wood from fast-growing pulpwood trees.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. No rate of dispersal was provided.

WOODEN CONTAINERS

Description

Produces wooden boxes and crates, veneer and plywood containers, baskets, barrels, tubs, hogsheads and other containers made of staves.

The output is consumed as an input to a variety of manufacturing industries.

Assumptions

General

1. Output and employment are projected to decline following historic trends; however, the decline will not be as rapid as in the past.

Technological

1. Technological changes in nondurable goods industries are having a negative effect on the demand for wooden containers. The changes are occurring in packaging technologies, such as plastics, styrofoam, and paperboard industries which will be substituted for wooden containers.

Rate of Development

1. Packaging technologies (e.g., plastics) will not continue to develop as fast as in the past.

Rate of Dispersal

1. Most of the packaging technologies (e.g., plastics) are already in use in other industries.

HOUSEHOLD FURNITURE

Description

Produces household furniture, such as beds, upholstered and unupholstered furniture made from wood, metal, plastic, glass, or wicker; dual-purpose sleep furniture, and mattresses and box springs.

The output is primarily consumed by individuals and as an input to new residential construction.

Assumptions

General

1. Most of the output from the industry is sold for personal consumption. Individuals' demand for household furniture will not grow as fast as total personal expenditures. This assumption reflects demographic assumptions, i.e., slowing growth and aging of population.

2. Furniture will be smaller and less will be needed because houses will be smaller.

Technological

1. There will be no significant new technologies in this industry.

Rate of Development

1. Not applicable.

Rate of Dispersal

1. Not applicable.

FURNITURE AND FIXTURES, EXCEPT HOUSEHOLD

Description

Produces wood and metal furniture, partitions, shelving, lockers, and fixtures for restaurants, stores and offices, and seats for automobiles.

The output is consumed as investment in furnishings for commercial or office buildings in both the private and public sectors.

Assumptions

General

1. Demand for this industry's output will not grow as fast as nonresidential construction. Office building construction drives the demand for this industry.

2. There will be a move away from nonresidential construction. The proportion of office buildings that will be built to all nonresidential construction will decline.

Technological

1. There will be no new technologies.

Rate of Development

1. Not applicable.

Rate of Dispersal

1. Not applicable.

GLASS

Description

Produces pressed and blown glass containers for packaging, flat glass for windows, lamppost globes, mirrors, cookware, goblets, bottles, and related glass specialties.

The output is consumed as an input to the construction, motor vehicle, food processing, and drug and toiletry preparation industries.

Assumptions

General

1. The soft drink industry will continue to move toward using lighter weight bottles by using more plastic or lighter weight glass bottles.

2. There will be healthy growth between 1977 and 1995 in the demand for glass for solar heating panels.

3. More glass will be used in telephone cables.

Technological

1. There will be no new technologies.

Rate of Development

1. Not applicable.

Rate of Dispersal

1. Not applicable.

CEMENT AND CONCRETE PRODUCTS

Description

Manufactures hydraulic cement, concrete, cinder blocks, lime, gypsum, and plaster products.

The output is consumed as an input to the construction industries.

Assumptions

General

1. This industry will grow more slowly than new construction because of the substitution of other materials in the construction process for cement.

2. There will be a slight increase in the use of glass or plastic as substitutes for concrete.

3. There will be a decline in the level of purchases by state and local governments for education construction (demographic assumptions) and health construction along with a slowing in the rate of highway construction.

Technological

1. The production process of cement will be converted from a wet process to a dry process. This will be done to lower fuel costs, because the wet process uses a large amount of energy.

2. New casting methods for pouring concrete will be used. These methods will allow concrete to be poured in cold weather and more rapidly.

3. The capacity of cement mixer trucks will increase.

4. Automatic batchers will be used. This will automate the batching process by proportioning the ingredients when mixing the concrete.

Rate of Development

1. All the technologies exist today and will be used more widely in the future.

ENCLOSURE I

Rate of Dispersal

1. The rate of dispersal will be slow because this industry is made up of many small firms and these technologies require large capital expenditures.

2. The change from the wet process to the dry process will be slow, as will be the adoption of the new automatic batchers.

3. The diffusion of trucks with a larger capacity will be more rapid than the change to the dry process and the adoption of the automatic batchers.

STRUCTURAL CLAY PRODUCTS

Description

Manufactures clay fire brick, chimney pipe, sewer pipe, conduit, wall coping, terra cotta and other structural and fire-resistant clay products.

The output is consumed as an input to the construction industries.

Assumptions

General

1. Forty-five percent of industry output is used for residential construction. It was assumed that demand for clay from residential construction will decrease between 1982 and 1995. The move from single-family homes to multifamily homes will continue and will decrease the need for products of this industry.

Technological

1. Demand will decrease for the products of this industry because metal and plastic will be substituted for clay products in construction (e.g., chimney flues and sewers will be made of plastic and metal products, respectively, rather than clay by 1995).

Rate of Development

1. No rate of development was provided.

Dispersal

1. No rate of dispersal was provided.

POTTERY AND RELATED PRODUCTS

Description

Produces vitreous china plumbing fixtures, bathroom accessories, earthenware articles, porcelain, china table and kitchen articles, and related products.

The output is consumed as an input to construction, intermediate processing industries and by individuals.

Assumptions

General

1. There will be a large increase in imports. This is because the industry is very labor intensive and labor is cheaper in foreign countries.

Technological

1. The porcelain engine (as a technological advancement) is beyond the forecasting horizon. It will have little effect by 1995.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. The porcelain engine will not be in widespread use by 1995.

OTHER STONE AND CLAY PRODUCTS

Description

Produces cut stone and cut stone products for paving; statuary, abrasives, asbestos products, gaskets, and ground or otherwise treated minerals and earths.

The output is consumed as an input to construction, intermediate processing industries, and by individuals.

Assumptions

General

1. This industry's output as a percentage of total inputs into other industries will remain even or decline by 1995. Other industries will continue to grow, which will result in an overall increase in employment for this industry.

Technological

1. There will be no new significant technological changes.

Rate of Development

1. Not applicable.

Rate of Dispersal

1. Not applicable.

BLAST FURNACES AND BASIC STEEL PRODUCTS

Description

Produces iron and steel from ore, scrap, and pig iron; and rolls hot and cold steel and iron into sheets in mills and blast furnaces.

The output is consumed as an input to steel industries for further processing, and to the motor vehicle and construction industries.

Assumptions

General

1. This industry sells its products to other industries. In total, the use of steel is increasing even though each industry is using a smaller percentage of steel as an input.

2. The level of imports will increase faster than the trend between 1972 and 1977. However, the steel that is imported may be a type that is not produced in the United States; therefore, increased imports may not necessarily displace workers.

3. The steel industry will use more business services.

Technological

1. Technological advancements will enable the industry to produce stronger steel that weighs less.

2. The use of advanced equipment, which has electronic components, will result in increased computer control over the production process.

3. There will be more widespread use of the direct reduction process, which is the treatment of pellets with hot gasses to refine them before melting.

4. The basic oxygen process will replace the open hearth process.

5. The use of electronic arc furnaces will increase. This will allow scrap metal to be used. Small companies/mills will use scrap metal because it is cheap, allowing them to proliferate.

6. The use of continuous casting will increase.

7. There will be increased usage of CAD/CAM.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. The basic oxygen process and the use of continuous casting will be used in half of all production by 1995.

2. The use of electronic arc furnaces will increase. There was no assumption made as to how quickly the furnaces will be installed by companies, or what share of the market they will account for.

3. The direct reduction process will rapidly increase in use. In 1982, it accounted for half of production.

4. The use of computer controls in the industry will be rapidly dispersed. In 1982, 10 percent of the industry used computer controls.

5. Modernization of the industry requires much capital. This puts a limit on how quickly existing technologies (e.g., direct reduction process) can be implemented.

IRON AND STEEL FOUNDRIES AND FORGINGS

Description

Produces iron and steel castings and forgings, cast iron railroad equipment, gears, axles, crankshafts, nails, spikes, and related metal products. The output is consumed as an input to the motor vehicle, construction, railroad equipment, and machinery industries.

Assumptions

General

1. Ninety percent of this industry's products are sold for use in other industries.

2. Imports and exports will increase, following historic trends.

3. Other industries will use less of this industry's products as a percentage of their inputs. Lighter weight materials are being substituted for many iron and steel products that were used in other industries.

Technological

1. New types of quality control equipment will be used. Examples of new equipment are ultrasonic and sonic testing devices.

2. New material handling equipment will be introduced into this industry.

3. A new application of conveyor belts will be introduced.

4. Automated finishing machinery will be used more. Instead of using individual grinders or chippers, the finishing process will be done by these machines. As a result, the occupation mix in the industry will be affected.

5. There will be an increase in the use of electric furnaces and mechanical pouring systems.

6. No-bake molding will be used for melting steel. Instead of cooking steel, no-bake molding uses a chemical reaction which enables the sand in the casts to be reused.

7. Some robots will be used in this industry for automatic die casting. Currently, robots are being used to a limited extent.

8. There will be increased use of CAD/CAM.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. Diffusion of technologies (e.g., no-bake molding) will be limited. It is very expensive to implement the technologies and the costs are increasing.

2. Use of electric furnaces and mechanized pouring systems will almost double by 1995. In 1982, use of these technologies was not very widespread.

PRIMARY COPPER AND COPPER PRODUCTS

Description

Produces refined, smelted, rolled, drawn, and extruded copper, brass and bronze; nonferrous wire and castings, and die cast copper and copper base alloys.

The output is consumed as an input to copper mills and primary copper industries.

Assumptions

General

1. Imports will increase by 1995. Exports will decrease because American manufacturers will not be able to compete with foreign competition.

2. The cost of environmental compliance (in refining and cleaning up mines) will be costly by 1995. As a result, the cost of copper will increase.

3. There will be a modest decline in percentage use of products from this industry in the production processes of other industries by 1995. Increased use of fiber optics and satellites for communication will lower relative demand for copper. Total demand by other industries will increase due to those industries' growth.

4. Some of the growth in the use of copper by 1995 will be as a result of growth in construction of non-residential structures since 1977.

Technological

1. There will be increased use of computer controls for product testing and production processes.

2. There will be increased use of CAD.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. The use of computer controls for testing will be more widespread than it is now.

PRIMARY ALUMINUM AND ALUMINUM PRODUCTS INDUSTRY

Description

Produces aluminum from alumina, and refines aluminum into cables, bars, pipes, plates, castings, and related aluminum specialties.

The output is consumed as an input to aluminum processing mills and to primary aluminum industries.

Assumptions

General

1. This is an intermediate industry with its output driven by the purchasing demands of other industries.

2. The United States will increase its imports of aluminum and aluminum products because the manufacturing of aluminum products is electric energy intensive and the demand for domestic hydroelectric power in the West and South matches supply, raising the cost of what was once a cheap source of energy.

3. Countries (e.g., Jamaica) that export bauxite to the United States want American manufacturers to produce more end-products in their countries. This will result in fewer jobs in the aluminum industry in the United States.

4. There will be increased demand for aluminum products as an input into other industries (e.g., as automobile manufacturing). Aluminum will replace steel in these industries as there is a demand for lighter weight materials.

5. Production processes in other industries will continue to be streamlined, thereby reducing the quantity of aluminum needed to make a product.

6. There will be more recycling of aluminum, because recycling is less energy intensive than primary manufacturing.

Technological

1. There will be an increase in the use of electronic equipment, which should improve production and productivity.

2. There will be increased use of CAD/CAM.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. New technologies will be implemented at a slow pace, being implemented in new plants but probably not in the old ones. The old plants are very capital intensive and will have a difficult time raising capital to finance adoption of new technologies.

PRIMARY NONFERROUS METALS AND PRODUCTS

Description

Smelts and refines lead and zinc, rolls and draws other nonferrous metals from basic ores, such as platinum and tin, and recovers alloys from scrap and dross.

The output is consumed by nonferrous rolling and drawing mills and by storage battery and aircraft producers.

Assumptions

General

1. The level of imports will increase from 23 percent in 1977 to 32 percent by 1995. This is the result of demand from other industries increasing and because the United States does not produce platinum or tin. The demand for platinum will increase because the automotive industry uses it as a catalyst in emission controls.

2. The industries that purchase the output will use less of the output as a total percentage of their production process. The industries will use less, partially because they will substitute other materials for the primary nonferrous metals, lead and zinc, to make lighter products. The level of output from this industry, however, will not drop.

Technological

1. The demand for some products of this industry will increase because catalytic converters will be used more, compared to other technologies, to control automobile emissions.

2. There will be increased use of computer controls for testing and production.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. The catalytic converter will be more pervasive in 1995 than in 1977.

METAL CONTAINERS

Description

Manufactures metal cans for food, beverages, milk, and oils; as well as metal barrels, drums, kegs, and pails.

The output is consumed as an input to the food, beverage, drug, chemical, and petroleum producing industries.

Assumptions

General

1. The industries that buy metal containers will continue to grow, although as a percentage of total consumption, these industries will use a decreased amount of metal containers due to the growth of other packaging materials.

2. This industry's output will increase at an average rate of 1 percent per year from 1977 to 1995.

3. Employment in this industry will continue to decline as it has since the 1970's.

Technological

1. Food products will be packaged differently. In the future, metal containers will be replaced with more plastic and paper containers. Frozen and convenience foods which are in flexible and semi-rigid containers will continue to replace canned foods.

2. There will be a decrease in the use of steel containers and an increase in aluminum containers. As a result, less welding will be required, because when aluminum is used, a can is made from one piece of metal. This change will increase the rate of productivity growth.

3. There will be increased use of CAD/CAM.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. Technologies will continue to be dispersed as in the past.

HEATING APPARATUS AND PLUMBING FIXTURES

Description

Produces nonelectric heating equipment, such as furnaces, boilers, and incinerators; plumbing fixtures; and other pressed metal and enameled sanitary ware.

The output is consumed by the construction industry.

Assumptions

General

1. Demand for this industry's output is driven by the demand for construction. This industry will grow with the construction industry.

Technological

1. There will be increased use of CAD/CAM.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. No rate of dispersal was provided.

FABRICATED STRUCTURAL METAL PRODUCTS

Description

Manufactures fabricated structural iron, steel, and other metal; metal doors, window sashes and frames; power and marine boilers; and produces sheet and ornamental metal work.

The output is consumed as an input to the construction industry.

Assumptions

General

1. Growth of this industry will follow the construction industry and government expenditures. Most of the demand for this industry's output comes from these expenditures.

Technological

1. Products will not change much in the way they are made.

2. One type of CAM is computer numeric control. The use of computer numeric control will automate more of the production process and will contribute to the growth in productivity.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. Computer numeric control is currently available, but not in widespread use. Diffusion of computer numeric control will not be rapid because it is expensive to implement and because this industry is made up of small firms.

SCREW MACHINE PRODUCTS

Description

Produces standard bolts, nuts, screws, rivets, wire goods, special industrial fasteners and related goods.

The output is consumed as an input to machinery and repair industries.

Assumptions

General

1. Other industries will use this industry's output for the same percentage of their total inputs by 1995 as they have in the past.

2. This industry's output will still have some growth because the industries that buy its output are growing. However, there will be no productivity growth. The combination of no productivity growth and growth in output means employment will increase in this industry.

Technological

1. There will be increased use of CAD/CAM.

Rate of Development

1. None.

Rate of Dispersal

1. Many small firms; dispersal slow.

METAL STAMPINGS

Description

Produces such stamped metal goods as auto body parts, hubs and trim, appliances and appliance parts, cookers, kitchen utensils, and related household and hospital utensils.

The output is consumed by the motor vehicle, appliance, and communication equipment industries.

Assumptions

General

1. The output of this industry will not increase as a percentage of the input to any industry and in some industries, it will decrease due to substituting plastic for metal.

2. The demand for this industry's output will grow because the industries that buy the output are growing. The increase to 1995 is expected to be large because 1982 was a depressed year. The auto industry, a major purchaser of this industry's output, is expected to grow.

Technological

1. There will be increased use of CAD/CAM.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. No rate of dispersal was provided.

CUTLERY, HANDTOOLS, AND GENERAL HARDWARE

Description

Manufactures scissors, knives, table cutlery, tools for metal and woodworking, hand saws, saw blades, and other general maintenance hand tools and miscellaneous hardware.

The output is consumed by the construction and metal-producing industries and by individuals.

Assumptions

General

1. Personal consumer expenditures (PCE) will continue as in the past, i.e., PCE will comprise one-fifth of the output of this industry. (Employment in this industry will increase due to increasing PCE and demand from the construction industry. In addition, the industry is recovering from the recession between 1980 and 1982.)

Technological

1. There will be increased use of CAD/CAM.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. No rate of dispersal was provided.

OTHER FABRICATED METAL PRODUCTS

Description

Produces miscellaneous wire products and metal hardware, valves and pipe fittings, tubes, safes, vaults, and other related metal goods. Firms in this industry plate, coat, or otherwise finish metals and other formed products.

The output is consumed as an input to the construction, heating, plumbing, and primary iron and steel industries.

Assumptions

General

1. This industry will sell 70% of its output to other industries in 1995.

Technological

1. There will be increased use of CAD/CAM.

2. There will be increased use of electronic components.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. No rate of dispersal was provided.

ENGINES, TURBINES AND GENERATORS

Description

Produces steam engines; steam, hydraulic, and gas turbines; diesel, semi-diesel, and other internal combustion engines (except automotive).

The output is consumed as investment in electric power plants, is used in truck production, and is purchased by the farm and construction machinery industries.

Assumptions

General

1. This industry responds to general economic conditions. As the economy improves, this industry will improve.

2. Equipment purchases for investment from this industry will rise slightly as compared to the decrease between 1972 and 1977. This is due to the improvements in the economy, which are expected to continue.

3. Exports will rise substantially.

4. Productivity will grow. Although it decreased during the recession, it is expected to increase an average of 4 percent per year between 1982 and 1995.

5. There will be increased use of electricity as a power source, and engines will become more efficient in their use of electricity.

Technological

1. There will be increased use of CAD/CAM in production.

2. There will be increased use of electronic components in production and in the products themselves.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. No specific assumptions about specific technologies were provided.

FARM MACHINERY

Description

Produces wheel farm tractors, threshers, mowers, tillers, and related farm machinery, lawn mowers, sprayers and spreaders, hair clippers, and feeding and watering equipment for animals.

The output is consumed as investment in agricultural and livestock industries.

Assumptions

General

1. A regression model was used to predict demand for labor. Productivity is projected to increase an average of 3.1 percent per year between 1982 and 1995.

2. Investment purchases will increase by an average of 1.1 percent per year between 1977 and 1995.

3. Exports and imports will each increase an average of 3.1 percent per year between 1977 and 1995.

Technological

1. There will be increased use of electronic components in this industry. The final products will have more electronic components, which will increase demand. Also, the machines that produce the farm machinery will be more electronically controlled, which may affect production in this industry.

2. There will be increased use of CAD/CAM.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. No rate of dispersal was provided.

CONSTRUCTION, MINING AND OILFIELD MACHINERY

Description

Produces bulldozers, concrete mixers, cranes, power shovels, oil field tools, drills, rigs, and ore crushers.

The output is consumed as capital investment in construction and mining; is purchased by these sectors as repair parts; and is exported.

Assumptions

General

1. Exports will more than double between 1977 and 1995. It was assumed that major oil finds have already been made in the United States. This growth in exports will be due to increased mining in foreign countries. (Exports do not include material to U.S. companies doing offshore drilling).

2. The domestic market will be limited. There will be a large boom in residential construction until 1988, and then a tapering off to 1995. This does not pertain to office building and factory construction where there will still be growth, but not as much as historically.

Technological

1. There will be increased use of CAD/CAM technology in the manufacturing of the industry's products and in the final products themselves. This will contribute to more efficient production. The demand for the products will increase because of the increased capability of the final products and these final products will become more efficient.

2. There will be increased use of electronic components in the manufacturing of the industry products and in the final products themselves. This will contribute to more efficient production. The demand for the products will increase because the products' capabilities will increase and they will become more efficient.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. There was no specific assumption made.

MATERIAL-HANDLING EQUIPMENT

Description

Produces both passenger and freight elevators, escalators, conveyors, vehicles, or systems for moving goods within plants and factories, including hoists, cranes, trucks, trailers, and stackers.

The output is consumed as capital investment by various industries; is purchased by these industries as repair parts for existing equipment; and is exported.

Assumptions

General

1. This industry is expected to grow an average of 2.8 percent per year between 1977 and 1995. This is an increase over the trend between 1972 and 1977.

2. There will be an increase in non-residential construction, resulting in an increased demand for this equipment by the construction industry.

Technological

1. There will be an increase in automated systems, controlling movement within the factory. It was assumed that there will be more automated material-handling equipment, such as hoists, conveyors, cranes, and robots.

2. There will be less of a demand for fork-lift trucks. Some of these functions will be taken over by automated hoist lift systems.

3. There will be increased use of robots. There will be more inputs of optical equipment into the production of robots.

4. There will be increased use of CAD/CAM.

5. There will be increased use of electronic components.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. Technology, such as automated material-handling equipment and robot controlled material-handling equipment, was available in 1982 and will become more widely used.

METALWORKING MACHINERY

Description

Produces a variety of machines, machine tools, accessories, and repair parts, such as dies, jigs, drills, balances, cutters, shapers, measuring devices, and industrial robots.

The output is consumed as capital investment; as replacement parts; and as special tools for existing capital.

Assumptions

General

1. The demand for products from this industry will increase because of the general recovery of the economy. The products from this industry are purchased by a wide range of industries; therefore, demand is directly linked to the economy.

Technological

1. Many new technologies will be increasingly used in producing metalworking machinery. The new technologies include:

- o numerical control,
- o computerized numerical control,
- o direct numerical control,
- o digital readouts,
- o adaptive control,
- o new cutting edges,
- o machining center,
- o CAD/CAM,
- o group technology, and
- o optical equipment in production of robots.

2. There will be increased use of electronic components.

Rate of Development

1. All of the technologies listed above will be at the forefront of development.

Rate of Dispersal

1. There will be slow dispersal of sophisticated technology because the industry is made up of many small companies and the technology is expensive. The technologies referred to here are: numeric control, machining centers, group technology, and CAD/CAM.

2. It was assumed that the following technologies will be widely used by 1995: digital readout, adaptive controls, and new cutting edges.

3. Robots with optical capabilities will not be in widespread use for many years.

SPECIAL INDUSTRY MACHINERY

Description

Produces machinery unique to particular industries, such as food processing equipment, textile and woodworking machinery, printing and paper presses.

The output is consumed as capital investment, as replacement parts for existing capital, and is exported.

Assumptions

General

1. There will be less than a 1-percent annual increase in equipment investment 1977 to 1995, which is the major demand component for this industry. Although there will be an increase, the 1995 investment level will be lower in real terms than the 1972 level.

2. Exports will increase between 1977 and 1995, resulting in growth in the output level of this industry. The domestic markets for these kinds of machinery are limited.

3. Imports will increase.

Technological

1. There will be an increase in the use of computer-controlled monitoring of production.

2. New types of machinery will be produced: in printing--laser printers and computer typesetting; in textiles--high production spinning and weaving equipment, and laser cutters; and in food production--new container technologies, such as new drinking containers or tamper-proof containers.

3. There will be increased use of CAD/CAM.

4. There will be increased use of electronic components.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. Introduction of the new technologies will be slow because the industry consists of small companies and the domestic market for these newer products (e.g., laser cutters, computer typesetting) is limited. Although the new machines are efficient, they are expensive and companies do not buy them because the demand for the output of these industries is not growing rapidly (saturation, strong foreign competition, etc.).

GENERAL INDUSTRIAL MACHINERY

Description

Produces pumps and pumping equipment, air and gas compressors, ball and roller bearings, fans, filters, and related items.

The output is consumed as an input to the production of other machinery, such as construction and farm machinery and metalworking equipment.

Assumptions

General

1. This industry follows the direction of the overall economy.

2. Exports will be the fastest-growing part of demand.

3. Output of this industry is a result of demand by other industries because much of this industry's products are intermediate demand purchases (e.g., spare parts) and not capital equipment.

Technological

1. CAD/CAM will be used as new engineering techniques in producing the machinery.

2. Electronic controlled systems will be used as new engineering techniques in producing the machinery.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. Electronic controlled systems and CAD/CAM will be in widespread use.

OTHER NONELECTRICAL MACHINERY

Description

Manufactures and repairs miscellaneous nonelectrical machinery and parts, such as pistons and piston rings, aircraft, engine, and motor vehicle valves, carburetors, and amusement park equipment.

The output is consumed by the motor vehicle, aircraft, primary metal, turbine producers, and automotive repair industries.

Assumptions

General

1. Over 90 percent of this industry's output will continue to be purchased by other industries.

2. This industry follows the trend for all the manufacturing industries.

Technological

1. There will be increased use of CAD/CAM.

2. Electronic components will be increasingly used as input to the industry's products.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. No rate of dispersal was provided.

COMPUTERS AND PERIPHERAL EQUIPMENT

Description

Produces electronic computers, control units, data storage devices, and input/output equipment (readers and printers), accounting machines, cash registers, hand-held calculators, and similar equipment.

The output is consumed by businesses as capital investments or leased capital, is purchased by the federal government for weapons guidance systems, and is exported.

Assumptions

General

1. Personal computers and related equipment will experience strong growth in the next decade.

2. Personal consumption expenditures will account for 10 percent of this industry's output by 1995, as compared to 0.2 percent in 1977.

3. Exports will grow at an average annual rate of 8.4 percent and account for 5 percent of all exports by 1995.

4. The dollar value of imports will continue to grow but will remain at about the same share of total output.

5. Investments will account for more than half the computer industry output. Investment growth is expected to be healthy.

6. Computer purchases will account for the largest capital purchases (20%) of all business spending.

7. Computer equipment will become smaller and less expensive.

8. Computer applications will become more powerful and be greatly expanded.

Technological

1. Computers will have less metal and more electronic components, which will make them smaller and lighter.

2. Helium-cooled modules will be replaced by water-cooled modules, which will allow for greater ease of manufacturing.

3. There will be a change in the size and capacity of electronic chips. They will be thinner in size and larger in capacity and speed of data processing.

4. Voice recognition, optical scanners, artificial intelligence, and improved data transmission are other developments which will affect the growth of this industry.

5. There will be increased use of CAD/CAM.

6. There will be increased use of electronic components.

Rate of Development

1. Because of the demand for new and expanded applications, all computer technologies are developing rapidly.

Rate of Dispersal

1. New technologies and applications will be implemented very rapidly because of the growing demand and declining costs.

ENCLOSURE I

TYPEWRITERS AND OTHER OFFICE EQUIPMENT

Description

Produces typewriters and other office equipment, such as word processors and mail handling machines.

The output is consumed as capital investment or as replacement parts by the private and public sectors.

Assumptions

General

1. There will be an increase in the share of consumer purchases of this industry's output, from 21 percent in 1977 to 30 percent by 1995.

2. There will be a slight increase in investment purchases share from 51 percent of industry output in 1977 to 53 percent by 1995. Technological changes will make current equipment obsolete. This will increase demand resulting in increased employment.

Technological

1. There will be movement away from old typewriters to word processors.

2. There will be increased use of electronic components in typewriters and other equipment, making the machines "smarter." Examples of these "smarter" machines are: those that open mail and stuff envelopes; optical character readers; and cash registers that respond to voice.

3. There will be increased use of CAD/CAM.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. Conversion to word processors does not require a large expenditure; therefore, diffusion of the word processor will be rapid.

2. If the demand is there, the diffusion of the impact printer can be rapid, because a radical change is not required in the production process.

3. There are many small firms in this industry, which will make diffusion of some "smart" machines slower.

SERVICE INDUSTRY MACHINES

Description

Produces air conditioning, refrigeration, and commercial laundry and dry cleaning equipment, as well as equipment for use by other service industries.

The output is consumed by the construction, motor vehicle, plumbing equipment, and business service industries.

Assumptions

General

1. Output growth will slow down because many of the markets are getting saturated; however, this is still a rapidly growing industry.

2. Equipment purchases will more than double by 1995 as compared to the 1977 level.

3. Exports will more than triple their 1977 level by 1995.

Technological

1. There will be increased use of computer-assisted manufacturing in the production of the machinery.

2. There will be increased use of electronic components in the production of the machinery.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. No rate of dispersal was provided.

ELECTRIC TRANSMISSION EQUIPMENT

Description

Manufactures instruments for measuring, testing, and distributing electricity, such as oscillators and voltmeters; transformers; and switchgear apparatus, including fuses and circuit breakers.

The output is consumed as an input to radio and television transmitting equipment, scientific equipment, electric utilities, and construction.

Assumptions

General

1. There will be a shift from petroleum to electricity as an economical source of energy.

2. There will be a healthy growth in exports. Exports will comprise 17 percent of the industry's total output by 1995. The United States will export more to developing countries.

Technological

1. There will be a large increase in the use of electronic components embedded in this industry's products.

2. There will be an increase in the use of computer quality control techniques in production and in computer design of parts and equipment.

Rate of Development

1. No specific rate of development was provided.

Rate of Dispersal

1. Computer quality control testing will be more widely used by 1995.

ENCLOSURE I

ELECTRICAL INDUSTRIAL APPARATUS

Description

Produces electric motors and motor starters, controllers and accessories, power generators, electrical capacitors, condensers, rectifiers, welding equipment, and carbon and graphite products.

The output is consumed as an input to producers of household appliances, refrigeration equipment, switchgear apparatus, machine tools, basic steel, and electrical apparatus.

Assumptions

General

1. Demand from the producers of durable equipment, a large source of demand for this industry, will increase from 1977 to 1995 at a slower rate than it did between 1972 to 1977, i.e., 5.8% per year versus 2.1%.

2. There will be slow growth in total energy use as well as a shift from petroleum to electricity as an energy source in order to economize.

3. The demand for output from this industry will increase relative to the increase in demand for all industrial products. The future trend will not change from the historic trend.

4. Productivity will increase at an average rate of 2.7 percent per year between 1982 and 1995.

Technological

1. There will be increased use of computer design and computer quality control.

2. There will be technological changes in the products produced by this industry. For example, welding equipment will become more automated. Demand for this equipment will increase as other industries modernize their own equipment.

3. There will be increased use of electronic components.

Rate of Development

1. Computer design and computer quality control will develop for the production process and in the products by 1995.

Rate of Dispersal

1. Computer design and computer quality control will be more widely used by 1995 than in 1982.

HOUSEHOLD APPLIANCES

Description

Produces household refrigerators and freezers, washers, dryers, stoves, vacuum cleaners, fans, and other electrical appliances, including garbage disposal units and sewing machines.

The output is consumed by individuals; as an input to new construction; to service industry machine producers; and to the hotel, personal, and repair services sector.

Assumptions

General

1. Productivity is projected to grow 2.6 percent a year 1982-95.

2. This industry is related to the housing industry. Residential construction will increase through 1990.

3. Personal consumption expenditures will account for 70 percent of total output by 1995. This is because consumer replacement demand will increase due to more electrical consumer products, such as computerized refrigerators, dishwashers, and microwave ovens.

Technological

1. There will be increased use of electronic components in this industry's products. This will increase the demand for the products. Solid state controls will replace mechanical controls.

2. Automated equipment will be used in the production process for electrostatic painting and coating.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. Electrostatic painting will be more widely used by 1995 than in 1982.

ELECTRIC LIGHTING AND WIRING

Description

Manufactures electric lighting equipment and fixtures such as fluorescent units, auto headlights, lamps and fixtures, current- and noncurrent-carrying wiring devices, and light bulbs and tubes.

The output is consumed as an input to new and repair construction, and to motor vehicle and communication equipment producers.

Assumptions

General

1. This industry will grow as total construction (residential and nonresidential) grows.

2. Productivity will grow at its historic rate, based on the Labor Demand Model.

Technological

1. There will be increased use of CAD/CAM.

2. There will be increased use of electronic components.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. No rate of dispersal was provided.

RADIO AND TELEVISION RECEIVING SETS

Description

Produces consumer electronic equipment such as radios, television sets, and stereo equipment; records, tapes, and related accessories; and public address systems.

The output is consumed by individuals and is exported.

Assumptions

General

1. There will be increased demand for electronic component products, such as video cassette recorders, compact audio discs, and televisions with electronic tuning.

2. There will be increased demand for cable television, which will require good quality televisions, as well as color televisions. Increased interaction of consumer and information available on TV's, e.g., home computers attached to TV's, at home shopping, home movies, ability to have magazines and newspapers shown on TV's.

3. Import penetration will be 35 percent of this industry's market by 1995. Most color televisions will continue to be imported from Korea, Taiwan, and Japan.

Technological

1. There will be increased use of CAD/CAM.

2. There will be increased use of electronic components.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. No rate of dispersal was provided.

TELEPHONE AND TELEGRAPH APPARATUS

Description

Manufactures such products as telephone and telegraph carrier equipment, headgear, and teletype machines.

The output is consumed as capital investment by the communications industry and related businesses and as an input to the industry itself.

Assumptions

General

1. There will be a healthy growth in this industry because of increased use of computer and intercommunication of businesses with computers.

2. There will be increased demand for telephones on the part of consumers. As a result of the American Telephone and Telegraph Company breakup, individuals are buying telephones instead of renting them.

3. There will be increased demand for telephones due to individuals hooking them up to computers, cellular phones in cars will also be a source of increased demand.

4. There will be a high productivity growth rate.

Technological

1. There will be technological changes or developments in this industry's products. These changes will drive demand for the products.

2. There will be increased use of CAD/CAM.

3. There will be increased use of electronic components.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. The products of this industry will be in widespread use quickly. There will be rapid change in the availability and implementation of new products.

RADIO AND COMMUNICATION EQUIPMENT

Description

Manufactures radio and television broadcasting equipment, signaling and detection devices, such as radar, air and highway traffic control systems, sonar and laser systems, and satellites.

The output is purchased by the federal government, the broadcasting industry, and is an input to aircraft, missile, and space vehicle production.

Assumptions

General

1. There will be an increase in imports.

2. In 1995, exports will account for a greater percentage of total output than in 1977. Those items being exported in particular are television and radio broadcasting equipment.

3. The Department of Defense (DOD) is a big purchaser of this industry's output. Because the size of the armed forces is not increasing, DOD equipment expenditures will account for the bulk of the increase in defense spending.

4. DOD's use of lasers will increase.

Technological

1. There will be healthy growth in this industry's productivity.

2. There will be increased use of CAD/CAM.

3. There will be new technologies in this industry. However, no assumption was made as to what those technologies will be.

4. There will be an increased use of electronic components.

Rate of Development

1. No assumption was made as to what the rate of development will be.

ENCLOSURE I

Rate of Dispersal

1. It was assumed that the new developments will be dispersed quickly. The use of lasers and electronic components in planes and ships already is widely dispersed through this industry.

ELECTRONIC COMPONENTS

Description

Produces electron tubes, such as radio and television tubes, semiconductors, condensers, transformers, fuel cells, magnetic recording tape, and related components and accessories.

The output is consumed as an input to radio, television, and communication equipment production, and is exported.

Assumptions

General

1. Imports will continue to grow. The United States will import the cheaper electronic components.

2. Exports will continue to grow. The United States will export more advanced electronic items.

3. There will be a large increase in DOD purchases because of the growth of electronic components in defense hardware.

4. Trade will move toward developing countries in the long run. The developing countries will have a need for goods that use electronic components.

5. Automation of the production process in general will increase its use of electronic components.

6. The makeup of this industry will change dramatically toward making items such as computer chips and semiconductors, as some of the current products become obsolete (e.g., radio tubes, television tubes).

7. By 1995, 91 percent of this industry's output will be used in production of other products.

8. Consumers will buy more electronic components. However, consumer purchases make up a small part of the industry's total output, only 6% in 1995.

Technological

1. Computer-aided design will be developed for making circuitry of chips in the production of semiconductors.

2. There will be a conversion from small chips to large thin wafers that hold many chips. This will expand production capacity.

3. Ultra-large scale integration will not account for a very large part of production.

4. There will be increased use of electronic components.

Rate of Development

1. Development will be very rapid for computer-aided design and conversion of chips to wafers.

Rate of Dispersal

1. The production processes that did not use electronic components in 1977 will be using them by 1995.

OTHER ELECTRICAL MACHINERY AND EQUIPMENT

Description

Produces starting motors, spark plugs, storage and primary batteries, electromedical equipment, such as X-ray equipment, armatures, and alternators and generators for both automobiles and aircraft.

The output is consumed by individuals and as an input to the motor vehicle and other industries.

Assumptions

General

1. Personal consumption expenditures will account for 31 percent of total output by 1995. This is due to increased use of batteries for such electronic products as calculators.

2. Exports will increase from 10 percent of output in 1977 to 19 percent by 1995. This industry will export x-ray and scientific equipment by 1995.

3. Purchasers of durable equipment are large buyers of the industry's output. These purchasers will not grow quickly by 1995.

Technological

1. There will be increased use of electronic components.

2. Electromedical equipment, one product of this industry, will undergo technological changes, thereby increasing the demand for it.

3. There will be increased use of CAD/CAM.

Rate of Development

1. The technologies for producing electromedical equipment used today will continue to be used in the future.

Rate of Dispersal

1. No rate of dispersal was provided.

ENCLOSURE I

MOTOR VEHICLES

Description

Produces automobiles, trucks, buses, trailers, and special purpose motor vehicles, such as ambulances, hearses, and fire trucks, as well as parts for them.

The output is consumed by individuals or as an input to the motor vehicle industry in the form of bodies and parts, and as investments.

Assumptions

General

1. The share of sales that are imports will increase from about 26 percent in 1982 to 30 percent by 1995. These figures include sales of parts to auto manufacturers manufacturing cars in the United States and employing workers from the United States.

2. Current trends will continue (e.g., V-8 engines will not be used, front-wheel drive will be used more, and flexible production lines will be used instead of planned set-up lines).

3. The trend toward lighter, more fuel efficient cars will continue. The amount of metals used will decrease, and the amount of plastics used will increase.

4. There will be an increase in the amount of business services used in the production of cars. For example, auto manufacturers will contract out for software for cars.

5. The workweek will not decline substantially. The long-term decline of the workweek will slow down.

6. More autos will be purchased by the business sector but the percent of this industry's output going to producer's durable equipment (PDE) drops slightly.

7. There will be a slowdown in the rate of increase of new drivers as a result of demographic changes in the U.S.

8. The price of cars will increase, which will result in people holding onto their cars longer.

9. Demand for motor vehicles is increasing, however, only slightly.

10. Small cars will be manufactured.

Technological

1. Industrial robots will be introduced in the production line for painting, welding, and material handling.

2. There will be increased use of CAD/CAM.

3. Computer controlled just-in-time inventory methods will be introduced. This will lower inventory costs, increase quality control and decrease repair time. However, using these methods does not necessarily mean there will be a decrease in the number of employees.

4. The use of electronic components in cars will increase.

Rate of Development

1. No rate of development was reported.

Rate of Dispersal

1. Robotics will not be in widespread use for other than painting, welding and material handling until optical capabilities are developed for them or they are made more flexible.

2. The use of CAD/CAM will be more widespread than it was in 1982.

AIRCRAFT

Description

Produces complete aircraft, such as planes, gliders, and helicopters; aircraft parts and auxiliary equipment, such as rocket motors, brakes, and landing gear; and engages in the research and development of aircraft.

The output is consumed by the federal government for defense and as an input to aircraft and guided missile production. It is also exported.

Assumptions

General

1. Defense expenditures will continue to grow. The average annual growth for defense aircraft purchases will be 2.8 percent from 1977 to 1995.

2. The number of civilian commercial aircraft will not increase. There will be increased spending for fleet replacement, quality improvement, and replacement parts. The number of military aircraft purchased will increase.

3. Exports will continue to increase and will remain higher than imports, which are also growing because of more competition from European aircraft, e.g., the airbus.

4. There will be a healthy growth in investments. There will be increased purchasers of domestic and private corporate aircraft.

5. There will be more co-production among aircraft manufacturers of various nations. They will purchase more aircraft parts from one another as opposed to manufacturing the parts themselves. Since the U.S. has been the major international supplier, co-production results in less U.S. exports since foreign purchasers will demand local production for some parts.

Technological

1. There will be increased use of CAD/CAM.

2. There will be increased use of composite materials and plastic.

3. There will be increased use of electronic components.

4. There will be increased use of industrial robots for assembly line production.

5. There will be increased use of near-net shape casting and power-metal casting, replacing machining. The use of these casting methods will decrease the need for machinists.

6. This industry will develop new aircraft and engines to replace the 707 and 727 aircraft and engines. Continued development of more energy and noise efficient engines is projected.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. No rate of dispersal was provided.

SHIP AND BOAT BUILDING AND REPAIR

Description

Produces both military and commercial ships and boats, barges, tugs, houseboats, and lighthouse tenders; and repairs all types of water vessels.

The output is consumed by the military services, as capital investment by the water transportation industry, as repair parts, and as consumer purchases.

Assumptions

General

1. There will be growth in DOD expenditures of 3.1% per year, twice as high as total industry output.

2. The producers' durable equipment level will stay fairly constant at the 1977 level. However, there will be little demand for oil rigs because there will not be much growth in petroleum.

3. There will be healthy growth in personal consumption expenditures.

Technological

1. There will be increased use of radio and communications equipment and electronic components in boats and ships. Increased use of radio and communications equipment will have minimal effect on employment in this industry.

2. There will be improvements in shipbuilding facilities: e.g., floating dry docks, bigger cranes that have a larger capacity for lifting, more automated equipment, and more prefabrication of parts.

3. There will be increased use of CAD/CAM.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. Dispersal will be fairly rapid for all the technological assumptions. Changes will occur quickly in the industry because the large demand for products by DOD will be an incentive to implement changes.

ENCLOSURE I

RAILROAD EQUIPMENT

Description

Builds and rebuilds railroad locomotives, streetcars, rapid transit cars, trackless trolley buses, and related equipment for operation on rails.

The output is consumed as investment and as an input to production and repair of railroad and streetcars.

Assumptions

General

1. Industry output will increase between 1982 and 1995 as compared to a 25 percent decrease between 1979 and 1982. However, this level will be lower than the output level in 1979 and higher than what it was in 1982. The increase in output by 1995 will increase employment from 1982's level.

2. Imports will increase, but will still be a small percentage of the output of this industry.

3. There will be an increase in productivity of this industry by 1995. When output fell between 1977 and 1982, productivity fell also.

Technological

1. There will be more automated methods of production by 1995.

2. There will be increased use of CAD/CAM.

3. There will be increased use of electronic components.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. No rate of dispersal was provided.

MOTORCYCLES, BICYCLES AND PARTS

Description

Manufactures motorcycles, bicycles, and similar equipment, such as caddy and golf carts, motor bikes and scooters, and also produces repair and replacement parts for such.

The output is consumed by individuals and as an input to the industry itself.

Assumptions

General

1. There will be a slight increase in demand in the bicycle market for recreation and exercise purposes by 1995.

2. There will be more disposable personal income.

3. Imports will continue to dominate the motorcycle and bicycle market. Although demand is high, domestic production is low because increased imports will supply almost all the increase in demand.

Technological

1. There will be increased use of CAD/CAM.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. No rate of dispersal was provided.

OTHER TRANSPORTATION EQUIPMENT

Description

Produces mobile homes, classrooms and commercial buildings; campers and travel trailers; snowmobiles; and pushcarts.

The output is consumed by individuals, by businesses for capital investment, and as an input to the industry itself.

Assumptions

General

1. The trend to improve campers' fuel efficiency will continue to 1995, thereby increasing demand for campers. The industry's output and employment levels will likewise increase.

2. There will be a decrease in the demand for mobile homes for housing by 1995.

Technological

1. There will be increased use of CAD/CAM.

2. There will be increased use of electronic components.

3. The fuel efficiency of campers will improve by 1995.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. No rate of dispersal was provided.

SCIENTIFIC AND CONTROLLING INSTRUMENTS

Description

Produces engineering, laboratory, scientific, and research instruments; as well as measuring, indicating, controlling, and recording apparatus, and counting devices.

The output is consumed as an input to the aircraft, motor vehicle, and construction industries, and to the industry itself.

Assumptions

General

1. Investment purchases of this industry's products will grow slower than the historical trend, dropping from 34% to 28% of the industry's output.

2. Exports and defense purchases will increase.

3. Demand for sensors and measuring devices (for quality control purposes) will rise faster than demand for other products of this industry.

4. Productivity will not increase much with usage of CAD/CAM, because this is not an industry with assembly line production.

Technological

1. There will be more high density integrated circuitry in the production of these instruments.

2. There will be increased use of electronic components.

3. There will be increased use of CAD/CAM.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. Most of the instruments that are products of this industry already use electronic devices or will soon use them.

MEDICAL AND DENTAL INSTRUMENTS

Description

Produces surgical, medical, and dental instruments and apparatus, and orthopedic, prosthetic, and surgical appliances and supplies.

The output is consumed as an input to medical services, as capital investment in medical services, and by individuals.

Assumptions

General

1. This industry will grow rapidly in terms of output.

2. The productivity growth in this industry has been negligible and will continue that way.

Technological

1. Some of the products produced by this industry will incorporate more advanced technology, such as new heart or dental equipment.

2. There will be increased use of CAD/CAM.

3. There will be increased use of electronic components.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. No rate of dispersal was provided.

OPTICAL AND OPHTHALMIC EQUIPMENT

Description

Produces optical equipment, such as lenses, prisms, microscopes, telescopes, field and opera glasses, eyeglasses, and ophthalmic measuring and testing instruments.

The output is consumed as an input to optical products, as capital investment in sighting and fire control equipment, and by individuals.

Assumptions

General

1. There will be very rapid growth in this industry. Investment demand will increase an average of 5 percent per year between 1977 and 1995.

Technological

1. There will be new technologies in the products being produced in this industry, such as infrared detectors, fiber optics, and lasers.

2. There will be increased use of electronic components.

3. There will be increased use of CAD/CAM.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. No rate of dispersal was provided.

PHOTOGRAPHIC EQUIPMENT AND SUPPLIES

Description

Produces cameras and camera parts, attachments and accessories; projectors; photocopy and microfilm equipment; sensitized cloth, paper, and plates; and developing chemicals.

The output is consumed by photo-finishing labs, blueprinting shops, commercial photographers, and motion picture studios.

Assumptions

General

1. This industry will have strong output growth. Investment purchases will grow, remaining the largest component of demand.

2. Exports will grow very rapidly, showing the fastest growth of demand components.

3. Imports will increase, but not as fast as exports. Imports will maintain the same share of output as in 1977.

4. The quality of this industry's output will continue to improve.

5. Productivity in this industry will continue to increase.

6. Demand for microfilm will increase.

Technological

1. There will be more new technology in the products produced by this industry.

2. The demand for new equipment and new cameras will increase because of the increased use of electronic components. For example, still cameras for making video tapes will be in greater demand.

3. There will be improvements in copiers. They will become intelligent machines and will be able to communicate with other office machines.

4. There will be increased use of CAD/CAM.

5. There will be more video imaging and computer graphics.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. No rate of dispersal was provided.

WATCHES, CLOCKS AND CLOCK-OPERATED DEVICES

Description

Manufactures watches, clocks, mechanisms for clock-operated devices, and clock and watch parts.

The output is consumed by individuals, as capital investment and as an input to a variety of industries.

Assumptions

General

1. Imports will increase and will increase from one-third of the output in 1977 to more than 50 percent by 1995. Both cheap digital watches and very expensive watches will be imported.

2. The United States will produce fewer of the cheaper watches.

Technological

1. There will be increased use of CAD/CAM.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. No rate of dispersal was provided.

JEWELRY AND SILVERWARE

Description

Produces both precious and semiprecious jewelry, with or without stones; silverware, plated ware, and stainless steel flatware; and costume jewelry and novelties.

The output is consumed by individuals, as an input to a variety of products and as capital investment.

Assumptions

General

1. Imports (from Italy, Hong Kong and other parts of the Far East) will increase their share of the output from 25 percent in 1977 to 37 percent in 1995.

2. Consumer purchases of products from this industry will grow more slowly than other purchases. This is due to demographic changes (e.g., the population is aging and there will be fewer people establishing households for the first time).

Technological

1. There will be no new technological innovations in this sector.

Rate of Development

1. Not applicable.

Rate of Dispersal

1. Not applicable.

MUSICAL INSTRUMENTS AND SPORTING GOODS

Description

Produces pianos, organs, other musical instruments and materials and parts for such; toys, games, sporting and athletic goods, and children's vehicles (except bicycles).

The output is consumed by individuals.

Assumptions

General

1. Personal consumption, the major demand category, will have some growth, but it is decreasing as a percent of the industry. It will decrease from 88 percent of output in 1977 to 84 percent in 1995.

2. There will be more offshore sources of products and, therefore, a growth in imports.

3. Exports will increase from 7 percent of output in 1977 to 12 percent in 1995. Its rate of growth will be faster than for all other components of demand.

4. Demand for video games will increase.

Technological

1. There will be increased use of computer chips and electronic circuits and components, resulting in electronic synthesizers and inexpensive electronic musical instruments. Therefore, demand for musical instruments will grow because of technological changes in the instruments.

2. There will be increased use of electronic components in video games.

3. There will be increased use of CAD/CAM.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. Electronic components in this industry's products will be more pervasive by 1995.

OTHER MANUFACTURED PRODUCTS

Description

Produces pens, pencils, and other office and artists' materials; buttons, needles, pins, and other notions; morticians' goods; advertising displays; and a variety of miscellaneous manufactured products.

The output is consumed by individuals, as an input to a variety of products and as capital investment.

Assumptions

General

1. Businesses will buy the same share of this industry's output in 1995 as they did in 1977.

2. Personal consumption in this industry will grow at less than half the rate of total personal consumption, falling from 27% to 24% of this industry, while exports increase from 6% to 13%.

Technological

1. No new technologies.

Rate of Development

1. Not applicable.

Rate of Dispersal

1. Not applicable.

ENCLOSURE II

ASSUMPTIONS REGARDING THE 40 HIGHEST GROWTH OCCUPATIONS[1] AS DEFINED BY BLS

BUILDING CUSTODIANS

Description

Building custodians keep buildings in clean and orderly condition. They may have additional duties and responsibilities, such as tending furnaces and boilers, performing routine maintenance activities, notifying management of need for repairs and additions, and cleaning snow or debris from sidewalks.

Assumptions

General

1. The demand for building custodians will be related to the number of buildings requiring such services.

2. Nonresidential construction is projected to increase by 30 percent between 1982 and 1995, thus increasing the demand for cleaning services.

3. Contracting out will continue to be the trend, rather than having in-house custodians.

4. Contractors will be more likely to employ part-time workers because they are usually paid less and the employer is not required to provide benefits.

5. The trend toward providing cleaning services to private residents will continue, possibly displacing private household workers.

Technological

1. New developments in machines and cleaning equipment will have a minimal effect on employment.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. No rate of dispersal was provided.

---

[1]During the interviewing, BLS economists grouped some of the occupations together and gave us the same assumptions for all the occupations within the group. There were a few additional assumptions for some of these occupations.

ENCLOSURE II

CASHIERS AND SALES CLERKS

Description

Cashiers receive and disburse money in establishments other than banks. Their work usually involves use of adding machines, cash registers, and change makers.

Sales clerks sell any of a large variety of goods or services, usually inexpensive, and are not required to have much knowledge of the product other than price. They may write sales slips and ring up sales.

Assumptions

General

1. These occupations will continue to be driven by industry growth, which is driven by personal consumption expenditures.

2. Self-service stores increase the need for cashiers, but lower the need for sales people. However, self-service may have reached its peak so its future effect on employment will be limited.

Technological

1. It was assumed that current and future technologies (scanners and computerized shopping) will not have a significant effect on employment in these occupations.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. No rate of dispersal was provided.

ENCLOSURE II

RECEPTIONISTS, SECRETARIES, AND TYPISTS

Description

Receptionists receive visitors coming into an establishment. They determine a visitor's purpose and direct them to the proper person or department. They may perform additional clerical duties, such as typing.

Secretaries schedule appointments, give information to callers, take and transcribe dictation, and otherwise relieve officials of clerical work and minor administrative and business details.

Typists type letters, reports, stencils, forms, addresses, or other straight-copy material from rough draft or corrected copy.

Assumptions

General

1. Employment growth will be contingent on the expansion of business activities, mainly, the growth in size of existing businesses and the creation of new businesses.

2. These occupations are employed throughout the economy and are not concentrated in any one industry.

Technological

1. Office automation, such as word processors and automated private branch exchanges will not lead to extensive replacement of receptionists, secretaries, or typists. However, office automation will affect these occupations by increasing productivity; for example, secretaries and typists who use word processors will be more productive than secretaries and typists performing similar work on typewriters.

2. Office automation will slow the growth of typists significantly and of secretaries to some extent, but will have little effect on the growth of receptionists.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. Word processing equipment will spread gradually throughout the economy by 1995. Implementation should occur first in large companies and later in smaller ones. By 1995, office automation will be generalized throughout the country.

2. Optical character recognition equipment and voice data entry machines will not be widely diffused in offices by 1995.

ENCLOSURE II

GENERAL CLERKS - OFFICE, CLERICAL SUPERVISORS, AND STOCK CLERKS

Description

General clerks may be assigned duties in accordance with the office procedures of individual establishments. Their duties may include some combination of bookkeeping, typing, stenography, and office machine operation.

Clerical supervisors supervise and coordinate activities of workers engaged chiefly in one type of clerical function, such as typing, filing, bookkeeping, and tabulating data.

Stock clerks receive, store, and issue equipment, material, merchandise, supplies, tools, dies or food stuffs. They also compile stock records in the stockroom, warehouse, or storage yard. Their work involves a combination of the following: checking incoming orders, classifying and inspecting when necessary, and storing supplies.

Assumptions

General

1. Employment will be affected by industry employment patterns and growth in the general economy because these occupations are widely dispersed throughout all industries.

Technological

1. It was assumed that there will be no technological changes or developments that will affect employment in this occupation.

Rate of Development

1. Not applicable.

Rate of Dispersal

1. Not applicable.

ENCLOSURE II

REGISTERED NURSE, AND LICENSED PRACTICAL NURSE AND NURSE'S AIDE, ORDERLY AND ATTENDANT

Description

Registered nurses (RN) administer nursing care to the ill or injured.

Licensed practical nurses (LPN) care for ill, injured, convalescent, and handicapped persons in hospitals, clinics, private homes, sanitaria, and similar institutions.

Nurse's aides, orderlies, and attendants assist in the care of patients, under direction of nursing and medical staff.

Assumptions

General

1. Employment will depend on the rate of growth of the industries in which they work. Four out of five RNs work in the health sector, which is made up of nine separate industries. All nine of these industries are projected to grow faster than most other industries.

2. The structure and performance of health care delivery systems will continue to evolve along historic patterns. For example, there will be:

   a. no dramatic change by 1995 in long-term care systems, and nursing home care will remain the dominant mode for providing long-term care and

   b. no dramatic shift in industry distribution of employment. The hospital sector will continue to predominate employment.

3. Health care financing will not change significantly between 1982 and 1995. For example:

   a. the present third party payment system will remain in place and

   b. cost-containment efforts and strategies to reduce utilization of health services will continue.

4. Cost-containment pressures will accelerate the increasing trend of shorter length of stay in hospitals.

5. Physicians will delegate more responsibility for patient care in hospitals to RNs.

Technological

1. Most technological advances in the health and medical field will continue to be labor-intensive instead of labor-saving with the exception of some breakthroughs, such as the polio vaccine.

2. Acute care, high technology models of hospital-based care, as currently used, will continue to predominate health care delivery systems despite the rapid development of alternative models.

3. Clinical practice and therapeutic technologies, such as "half-way technologies" (the ability to treat a disease but not cure it), will be extended.

4. The long-term pattern of more and more specialized clinical care by registered nurses reflects the great expertise needed to monitor increasingly complex equipment and organizational innovations such as intensive care units, coronary care units, and burn units.

Rate of Development

1. High technology-based models of hospital care will continue. This will require a higher level of skill, thus increasing the demand for RNs as compared to licensed practical nurses and nurse's aides.

Rate of Dispersal

1. There will be gradual implementation of new technologies between 1982 and 1995.

2. Hospitals will increasingly acquire new technologies to constrain cost. This will require more registered nurses in proportion to LPNs, aides, and orderlies.

WAITERS and WAITRESSES, COOKS (RESTAURANT), AND COOKS (FAST FOOD)

Description

Waiters and waitresses serve food and/or beverages to patrons at tables. They usually take orders from patrons, make out checks, and may set tables with linen and silverware, as well as take payment from patrons. They may serve customers at counters as well as at tables.

Cooks (restaurant) prepare, season, and cook soups, meats, vegetables, desserts, and other food stuffs in restaurants. They may order supplies, keep records and accounts, price items on the menu, plan the menu, etc.

Cooks (fast food) prepare and cook to order all types of food requiring only short preparation time. They may also take orders from customers and serve patrons at counters or tables.

Assumptions

General

1. The growth in this occupation will depend on the growth in the food industry.

2. The food industry will continue to expand because more people are eating out, the population continues to increase, incomes are increasing, and more women are working.

3. Standard restaurants are expanding their share of the market relative to fast food. Fast food has peaked, but is still growing.

Technological

1. It was assumed that there will be no technological changes or developments that will affect employment in this occupation.

Rate of Development

1. Not applicable.

Rate of Dispersal

1. Not applicable.

TEACHERS (KINDERGARTEN AND ELEMENTARY)

Description

Kindergarten and elementary school teachers introduce children to the basics of mathematics, language, science, and social studies. They also arrange class trips, speakers, and class projects.

Assumptions

General

1. Enrollment will increase between 1982 and 1995 by 22 percent.

2. The number of teachers per thousand students will increase by 1995.

Technological

1. It was assumed that there will be no technological changes or developments that will affect employment in this occupation. The use of computers in schools will increase but only as an aid to teachers. The increased use of computers will not affect the employment of teachers.

Rate of Development

1. Not applicable.

Rate of Dispersal

1. Not applicable.

TRUCK DRIVERS, AND DELIVERY AND ROUTE WORKERS

Description

Truck drivers drive trucks or tractor trailers to transport materials to and from specified destinations, such as railroad stations, plants, construction sites, or within industrial yards.

Delivery and route workers drive trucks or other vehicles to deliver, sell, pick up, and display merchandise and products. They operate within a specified locality or over an established local route. They may solicit new business, collect money for items delivered, gather coins, and refill vending machines.

Assumptions

General

1. The growth of these occupations will depend on the growth of the industries in which they are employed.

2. The nation's highways will continue to be improved, thus facilitating the movement of more goods by trucks.

3. There will be a change in the mixture of trucks from small trucks to more tractor trailers and tandems.

Technological

1. Computer-routing systems will come into greater use resulting in dispatchers becoming more efficient at scheduling routes.

2. There will be improvements in material-handling equipment and more widespread refinements of existing equipment, such as industrial trucks.

3. New technologies, for example, warehouse automation and industrial robots, will be implemented. The implementation of these new technologies will improve productivity by allowing trucks to be loaded and unloaded more quickly.

Rate of Development

1. The development of new technologies will be gradual.

Rate of Dispersal

1. No rate of dispersal was provided.

SALES REPRESENTATIVE - NONTECHNICAL, AND SALES REPRESENTATIVE - TECHNICAL

Description

Sales representative - nontechnical, includes people concerned with selling where a knowledge of the goods or services sold is required. They may also sell products door to door with or without an appointment.

Sales representative - technical, includes people concerned with selling where a knowledge of the goods or services sold is required. The technical sales occupation requires specialized scientific or technical knowledge. Example of sales areas are aircraft, agriculture, and electronics.

Assumptions

General

1. These occupations are driven by industry growth, which is driven by personal consumption expenditures.

2. Wholesale products are becoming more complex and diverse and, therefore, more people will be needed to explain and sell these products.

Technological

1. Technology will have an indirect effect on these occupations. As more products are created, the buying process becomes more difficult and this increases the demand for knowledgeable sales people.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. No rate of dispersal was provided.

ACCOUNTANTS AND AUDITORS

Descriptions

Accountants and auditors examine, analyze, and interpret accounting records for the purpose of giving advice or preparing statements; install, or advise on systems for recording cost or other financial and budgetary data.

Assumptions

General

1. The use of computers by accountants and auditors will increase by 1995.

2. Employment will depend on the rate of growth of the industries in which accountants work.

Technological

1. It was assumed that there will be no technological changes or developments that will affect employment in this occupation.

Rate of Development

1. Not applicable.

Rate of Dispersal

1. Not applicable.

AUTOMOTIVE MECHANICS

Description

Automotive mechanics repair and overhaul automobiles, buses, and trucks. They may be designated according to speciality as automobile mechanic, bus mechanic, differential repairer, engine-repair mechanic, truck mechanic.

Assumptions

General

1. The number of licensed drivers and motor vehicles in operation will continue to grow.

2. This occupation depends on industry growth.

Technological

1. Automotive technology will continue to change and will become more complex with increased use of electronic components.

2. Automotive service and repair will become more complex due to the increased complexity of vehicles and increased use of computerized diagnostic equipment for servicing cars.

3. There is a growing specialization among mechanics. General mechanics cannot keep up with the growing number of changes in automotive technology.

4. Small gas station and garage owners will not be able to compete with large dealerships, which have resources for training mechanics in new technologies and the use of computerized diagnostic equipment. Dealerships will gain a bigger share of the automotive repair market.

5. Growing complexity of cars will make it increasingly difficult for car owners (or amateurs) to fix their own automobiles. As a result, more cars will have to be professionally serviced by automotive mechanics.

ENCLOSURE II

Rate of Development

1. Developments in automotive technology and automotive service technology will be gradual from 1982 to 1995. The technology will change in the future at a slower rate than over the past 5 years.

Rate of Dispersal

1. Dispersal of changes or new technologies will be gradual. Although new car models come out every year, the stock of cars on the road is a mixture of old and new cars with different types of technology. As older cars are retired and replaced with newer cars, the mix of technology stock gradually changes and the types of cars repaired changes.

SUPERVISORS OF BLUE COLLAR WORKERS

Description

Supervisors direct and coordinate activities of workers engaged in service occupations and maintenance, construction, repair, material handling, and power plant occupations. They study work schedules and estimate employee-hour requirements for completion of job assignments.

Assumptions

General

1. Employment in this occupation is driven by industry growth.

2. There will be a dramatic rebound in construction, and selected manufacturing industries, which will counter-balance the reduction of supervisors resulting from improved productivity.

Technological

1. It was assumed that technology affects this occupation indirectly. For example, robotics and numerically controlled machine tools improve productivity. This reduces the number of production line workers, which, in turn, reduces the number of supervisors.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. No rate of dispersal was provided.

FOOD PREPARATION, SERVICE WORKERS (FAST FOOD RESTAURANTS) AND KITCHEN HELPERS

Description

Food preparers are employed in fast food-type restaurants, whose menu is limited to a few primary items, such as hamburgers, roast beef, or chicken. Duties are rotated between counter service and kitchen duties in such a way that any one worker will perform all or most duties and operate all or most equipment over a period of time.

Kitchen helpers perform tasks to maintain kitchen work areas and restaurant equipment and utensils in a clean and orderly condition.

Assumptions

General

1. Employment will increase because the industries in which these occupations are found will continue to expand.

Technological

1. It was assumed that there will be no technological changes or developments that will affect employment in these occupations.

Rate of Development

1. Not applicable.

Rate of Dispersal

1. Not applicable.

ENCLOSURE II

GUARDS AND DOORKEEPERS

Description

Guards stand guard at entrance gates or walk about premises of businesses or industrial establishments. They prevent theft, violence, or infractions of rules and guard property against fire, theft, vandalism, and illegal entry. Also, they direct patrons or employees and answer questions relative to services of the establishment and control traffic to and from buildings and grounds.

Assumptions

General

1. Employment in this occupation will be driven by the growth of the industries which employ them.

Technological

1. Security devices will not have any adverse effect on the employment of security guards.

Rate of Development

1. Not applicable.

Rate of Dispersal

1. Not applicable.

STORE MANAGERS

Description

Store managers manage retail stores, performing the following duties personally or through subordinates: hire, train, and discharge employees; plan work schedules and supervise workers; prepare purchase orders; and formulate price policy.

Assumptions

General

1. BLS projects a decrease in the ratio of sales and clerical workers to store managers by 1995 in the following industries: motor vehicle dealers, grocery stores, gas stations, and miscellaneous stores. The proportionate number of store managers will increase to offset this decrease in clerical and sales workers.

2. The growth of this occupation will depend on the growth of the industries in which they are employed.

Technological

1. The use of optical scanners will reduce the number of people in such jobs as baggers while proportionately increasing the need for managers.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. The industries in which store managers are employed will project the rate of growth.

CARPENTERS

Description

Carpenters perform the carpentry duties necessary to make or repair wooden structures, structural members, and fixtures and equipment, using carpentry tools and woodworking machines.

Assumptions

General

1. Employment of carpenters will depend on the level of construction activity, which will increase from a low in 1982 (due to the recession) and continue to grow, leading to an increased level of employment of carpenters.

Technological

1. New materials, such as wallboards and Pre-Fab housing, will not have a significant effect on the employment of carpenters.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. No rate of dispersal was provided.

ELECTRICAL ENGINEERS, AND ELECTRICAL AND ELECTRONIC TECHNICIANS

Description

Electrical engineers perform engineering work in designing, planning and overseeing such activities as the manufacture, operation, and maintenance of electric or electronic components or equipment.

Electrical and electronic technicians have a background in electrical or electronic theory, physical science, and mathematics, enabling them to do jobs above routine operating or maintenance levels.

Assumptions

General

1. Defense spending will continue to grow.

2. Between 1992 and 1995, research and development expenditures will increase by 53.5 percent.

3. Research and development (R&D) for computers, electronic components and telecommunications will increase more rapidly than R&D in general.

4. Engineers are creating the new technologies that are affecting other occupations. Development of new technology is the driving force behind employment growth in this occupation.

5. Foreign and domestic competition is keen now and will be keen in the future.

6. Growth in these occupations will depend on the industries which employ them.

Technological

1. Computer-assisted design and computer-assisted manufacturing (CAD/CAM) will not affect the employment of engineers and technicians, however, it should help them become more productive.

Rate of Development

1. No assumption was made.

Rate of Dispersal

1. No rate of dispersal was provided.

COMPUTER PROGRAMMERS AND SYSTEMS ANALYSTS

Description

Computer programmers convert symbolic statements of business, scientific, and technical problems into detailed logical flowcharts.

Systems analysts analyze business, scientific, and technical problems for application to electronic data processing systems.

Assumptions

General

1. More industries will be forced to use computers to compete in the world market.

2. Growth in this occupation will depend on the growth in the industries that employ large numbers of workers in these occupations.

Technological

1. Improvements in computer technology will result in lower-cost computers and increased computer use by more industries.

2. Although technologies existing in 1982 were considered, it was assumed that there would be no dramatic changes by 1995 in technologies (e.g., artificial intelligence) that would offset the increasing demand for computer programmers and system analysts.

Rate of Development

1. Improvements in technology will increase computer applications and the results will be greater use of computers by more industries.

Rate of Dispersal

1. No rate of dispersal was provided.

MAINTENANCE REPAIRERS, GENERAL UTILITY

Description

Maintenance and general utility repairmen perform work involving two or more maintenance skills to keep machines, mechanical equipment, and/or the structure of an establishment in repair. This occupation is generally found in a small establishment where specialization in maintenance work is impractical. Examples of their duties are pipefitting, boilermaking, insulating, and welding.

Assumptions

General

1. Employment will be determined by growth in the industries that employ large numbers of these workers.

Technological

1. It was assumed that there will be no technological changes or developments affecting this occupation.

Rate of Development

1. Not applicable.

Rate of Dispersal

1. Not applicable.

HELPERS, TRADES

Description

Helpers assist one or more workers in the skilled trades by performing specific or general duties of lesser skill, such as keeping a worker supplied with materials and tools. They clean work areas, machinery, and equipment and assist workers by holding materials or tools and performing other unskilled tasks as directed by craft workers.

Assumptions[2]

General

1. The construction industry employs 55 percent of the workers in this occupation and the remaining 45 percent is spread across other industries.

2. Employment in this occupation will be driven by industry growth.

Technological

1. The employment of helpers will grow more slowly than the trade people they help. This will be especially true in large construction firms that will continue to adopt new technologies, such as lifts, cranes, and motorized material movers.

2. Smaller construction firms will not use the new technologies (lifts, cranes, etc.) and most helpers will continue to work for smaller firms.

3. The reduced need for helpers in large firms will be offset by the continual demand for helpers in small firms.

4. The primary results of technological changes will be the way in which materials are moved to the tradespeople who use them.

---

[2]Assumptions are those for helpers in the construction industry.

Rate of Development

1. No rate of development was provided.

Rate of Dispersal

1. Firms that are going to use the new technologies have already purchased the equipment and continue to upgrade as new technologies become available.

2. These new technologies are expensive; therefore, small firms will not implement them very quickly.

ELECTRICIANS

Description

Electricians install, maintain, and repair wiring, electrical equipment, and fixtures. They ensure that work is in accordance with relevant codes and may read blueprints.

Assumptions

General

1. Employment of electricians will be related to the level of construction and manufacturing activity. This activity will pickup, thus leading to increased employment for electricians.

Technological

1. The demand for electronic and electrical equipment will increase, which implies the need for more electricians; however, equipment will be easier to install and maintain, thus offsetting the increased demand for electricians.

Rate of Development

1. No assumptions were made.

Rate of Dispersal

1. No rate of dispersal was provided.

PHYSICIANS

Description

A physician is a doctor of medicine who diagnoses and treats mental or physical disorders. The physician may specialize in surgery, obstetrics, psychiatry, etc.

Assumptions

General

1. The structure and performance of the health care system will continue to evolve along historical patterns, specifically an acute-care, high technology, specialty medicine model of care.

2. Private practice will continue to predominate physician care, but there will be a gradual shift toward group and other salaried employment practice.

3. The present third party payment system will remain in place.

4. Employment as a physician will depend on growth of demand for health care.

Technological

1. There will be continued developments and applications of new diagnostic and therapeutic technologies, such as chemotherapy and radiation therapy.

2. Advances in medical technology will encourage more specialization, which will require more highly skilled physicians.

Rate of Development

1. There will be no major technological breakthrough in the treatment of accute and chronic illness that would significantly alter current employment patterns.

Rate of Dispersal

1. No rate of dispersal was provided.

COMPUTER OPERATORS

Description

Computer operators monitor and control electronic computers to process business, scientific, engineering, and other data, according to operating instructions.

Assumptions

General

1. The increasing use of computer equipment will lead to greater employment of computer operators.

2. Employment will depend on the rate of growth of the industries in which computer operators work.

Technological

1. Improvements in computer equipment will make it more powerful, less expensive, and more readily available. For instance, the less expensive personal computer will be used by more small companies and the more powerful minicomputer will be affordable by medium-sized companies.

Rate of Development

1. Improvements in computer equipment will continue through 1995 at the current rate.

Rate of Dispersal

1. No rate of dispersal was provided.

LAWYERS

Description

Lawyers conduct criminal and civil lawsuits, draw up legal documents, advise clients as to legal rights, and practice other phases of law. They may represent clients in court, or before quasi-judicial or administrative agencies of government and may specialize in a single area of law, such as patent law or corporate law.

Assumptions

General

1. Employment will depend on the rate of growth of the industries in which they work.

2. Self-employed lawyers will increase more slowly than those on salaries.

3. Lawyers will continue to be heavily employed in government and legal services.

Technological

1. It was assumed that computers are still too new to assess what their impact will be on the employment of lawyers by 1995.

Rate of Development

1. Not applicable.

Rate of Dispersal

1. Not applicable.

BOOKKEEPERS (HAND)

Description

Bookkeepers keep records of financial transactions of establishments. They may also keep one section or set of financial records.

Assumptions

General

1. Employment growth will be contingent on the expansion of business activities; mainly, the growth in size of existing businesses and the creation of new businesses.

2. Bookkeepers will be found throughout the economy, but the majority (66 percent) are employed in wholesale and retail trade, service and finance and insurance and real estate industries. These industries have experienced healthy growth and are expected to continue doing so.

Technological

1. Computerization has had a significant effect on employment in this occupation by slowing down the rate of growth. This trend will continue, causing the employment of bookkeepers to grow more slowly than average.

Rate of Development

1. Computerization will continue to develop, but its adverse effect will be offset by the rapid increase in the volume of business transactions.

Rate of Dispersal

1. Computerization will continue to spread between 1982 and 1995. There will be further evolution of labor-saving technologies and continued diffusion throughout the economy, resulting in higher productivity and a slower-than-average rate of growth for this occupation.

BANK TELLERS

Description

Bank tellers cash checks and process deposits and withdrawals. They also sell savings bonds, accept payment for customers' utility bills, receive deposits for Christmas club accounts, and compute interest on savings accounts. Bank tellers may go by other titles, such as customer representatives.

Assumptions

General

1. The banking industry will expand and take measures to improve banking services.

2. The number of tellers will increase at approximately the same rate as industry growth. However, growth in tellers will be moderated by the growth in banking services available in other industries. For example, many retail stores will now cash customers' personal checks. The effect of other industries performing banking services will be difficult to assess.

Technological

1. There will be increased use of automated teller machines (ATM). However, there is conflicting evidence on the effect of these machines on employment of tellers. As of 1982, ATMs had not affected on tellers as much as would have been expected. It was assumed that if ATMs were to affect on tellers, they would have already influenced the employment levels of tellers. There were no technological changes assumed for automatic teller machines. The ATMs currently in use and those of the future will be used for certain services (e.g., cashing checks, depositing money), while other activities will still have to be performed by tellers (e.g., opening accounts, verifying checks). Until ATMs provide the same services as tellers, the ATMs will not have an effect on employment of tellers.

2. Data processing equipment will be used more, and the equipment itself will be improved. Currently, this equipment is widely used, and its use will continue to moderate the employment of tellers. Future changes in the equipment will not affect employment of the tellers.

ENCLOSURE II

Rate of Development

1. It was assumed there would be no technological changes or developments for automatic teller machines.

2. It was assumed there would be no technological changes for data processing equipment.

Rate of Dispersal

1. ATMs will be widely dispersed by 1995.

ENCLOSURE III

BLS-PROJECTED EMPLOYMENT IN THE DURABLE GOODS INDUSTRIES
(in thousands)

Industry	1982 Actual	1995 Projected[1]	Difference (1995-1982)	Percent Change
Ordnance	79	85	6	7.6
Complete Guided Missiles and Space Vehicles	105	140	35	33.3
Logging	126	128	2	1.6
Sawmills and Planing Mills	179	209	30	16.8
Other Millwork, Plywood and Wood Products	317	419	102	32.2
Wooden Containers	15	11	(4)	(26.7)
Household Furniture	270	357	87	32.2
Furniture and Fixtures (Except Household)	180	206	26	14.4
Glass	173	212	39	22.5
Cement and Concrete Products	209	240	31	14.8
Structural Clay Products	34	30	(4)	(11.8)
Pottery and Related Products	40	49	9	22.5
Other Stone and Clay Products	132	182	50	37.9
Blast Furnaces and Basic Steel Products	394	447	53	13.5
Iron and Steel Foundries and Forgings	221	270	49	22.2

[1]This is the moderate-trend projections which are based on assumptions and results of a moderate-growth alternative, both in terms of aggregate economic activity and industry demand patterns. In contrast, the low-trend projections are comparable to the 1973-82 period, and the high-trend projection corresponds more to that of the 1960's.

ENCLOSURE III

BLS PROJECTED EMPLOYMENT IN THE DURABLE GOODS INDUSTRIES
(in thousands)

Industry	1982 Actual	1995 Projected[1]	Difference (1995-1982)	Percent Change
Primary Copper and Copper Products	135	170	35	25.9
Primary Aluminum and Aluminum Products	140	178	38	27.1
Primary Nonferrous Metals and Products	80	85	5	6.3
Metal Containers	64	62	(2)	(3.1)
Heating Apparatus and Plumbing Fixtures	61	78	17	27.9
Fabricated Structural Products	461	619	158	34.3
Screw Machine Products	92	121	29	31.5
Metal Stampings	187	252	65	34.8
Cutlery, Handtools, and General Hardware	143	200	57	39.9
Other Fabricated Metal Products	331	430	99	29.9
Engines, Turbines and Generators	113	167	54	47.8
Farm Machinery	139	172	33	23.7
Construction, Mining and Oilfield Machinery	254	357	103	40.6

[1]This is the moderate-trend projections which are based on assumptions and results of a moderate-growth alternative, both in terms of aggregate economic activity and industry demand patterns. In contrast, the low-trend projections are comparable to the 1973-82 period, and the high-trend projection corresponds more to that of the 1960's.

ENCLOSURE III

BLS-PROJECTED EMPLOYMENT IN THE DURABLE GOODS INDUSTRIES
(in thousands)

Industry	1982 Actual	1995 Projected[1]	Difference (1995-1982)	Percent Change
Material Handling Equipment	87	125	38	43.7
Metalworking Machinery	319	400	81	25.4
Special Industry Machinery	176	213	37	21.0
General Industrial Machinery	283	356	68	23.6
Other Nonelectrical Machinery	292	345	53	18.2
Computers and Peripheral Equipment	428	694	266	62.1
Typewriters and Other Office Equipment	47	69	22	46.8
Service Industry Machines	159	214	55	34.6
Electrical Transmission Equipment	215	256	41	19.1
Electrical Industrial Apparatus	206	288	82	39.8
Household Appliances	142	188	46	32.4
Electric Lighting and Wiring	187	253	66	35.3
Radio and Television Receiving Sets	93	113	20	21.5
Telephone and Telegraph Apparatus	148	209	61	41.2

[1]This is the moderate-trend projections which are based on assumptions and results of a moderate-growth alternative, both in terms of aggregate economic activity and industry demand patterns. In contrast, the low-trend projections are comparable to the 1973-82 period, and the high-trend projection corresponds more to that of the 1960's.

ENCLOSURE III

BLS-PROJECTED EMPLOYMENT IN THE DURABLE GOODS INDUSTRIES
(in thousands)

Industry	1982 Actual	1995 Projected[1]	Difference (1995-1982)	Percent Change
Radio and Communication Equipment	424	460	36	8.5
Electronic Components	561	850	289	51.5
Other Electrical Machinery and Equipment	153	194	41	26.8
Motor Vehicles	707	860	153	21.6
Aircraft	629	709	80	12.7
Ship and Boat Building and Repair	223	270	47	21.1
Railroad Equipment	37	50	13	35.1
Motorcycles, Bicycles, and Parts	14	20	6	42.9
Other Transportation Equipment	74	109	35	47.3
Scientific and Controlling Instruments	226	349	123	54.4
Medical and Dental Instruments	158	272	114	72.2
Optical and Ophthalmic Equipment	77	92	15	19.5
Photographic Equipment and Supplies	140	177	37	26.4
Watches, Clocks and Clock-Operated Devices	18	21	3	16.7

[1]This is the moderate-trend projections which are based on assumptions and results of a moderate-growth alternative, both in terms of aggregate economic activity and industry demand patterns. In contrast, the low-trend projections are comparable to the 1973-82 period, and the high-trend projection corresponds more to that of the 1960's.

ENCLOSURE III

BLS-PROJECTED EMPLOYMENT IN THE DURABLE GOODS INDUSTRIES
(in thousands)

Industry	1982 Actual	1995 Projected[1]	Difference (1995-1982)	Percent Change
Jewelry and Silverware	76	98	22	28.9
Musical Instruments and Sporting Goods	130	146	16	12.3
Other Manufactured Products	218	218	0	0

[1]These are moderate-trend projections that are based on assumptions and results of a moderate-growth alternative, both in terms of aggregate economic activity and industry demand patterns. In contrast, the low-trend projections are comparable to the 1973-82 period, and the high-trend projection corresponds more to that of the 1960's.

ENCLOSURE IV

BLS-PROJECTED EMPLOYMENT IN THE 40 LARGEST GROWTH OCCUPATIONS BETWEEN 1982 AND 1995
(in thousands)

Occupation	1982 Actual	1995 Projected[1]	Difference (1995-1982)	Percent Change
Building Custodians	2828	3606	778	27.5
Cashiers	1570	2314	744	47.4
Secretaries	2441	3161	720	29.5
General Clerks, Office	2348	3044	696	29.6
Sales Clerks	2916	3601	685	23.5
Nurses, Registered	1312	1954	642	48.9
Waiters and Waitresses	1665	2227	562	33.8
Kindergarten and Elementary School Teachers	1366	1877	511	37.4
Truck Drivers	1604	2029	425	26.5
Nursing Aides, Orderlies and Attendants	1218	1642	424	34.8
Sales Representatives, Technical	1320	1707	387	29.3
Accountants and Auditors	856	1200	344	40.2
Automotive Mechanics	844	1168	324	38.4
Blue Collar Workers, Supervisors	1200	1519	319	26.6
Kitchen Helpers	850	1155	305	35.9

[1]This is the moderate-trend projections which are based on assumptions and results of a moderate-growth alternative, both in terms of aggregate economic activity and industry demand patterns. In contrast, the low-trend projections are comparable to the 1973-82 period, and the high-trend projection corresponds more to that of the 1960's.

ENCLOSURE IV

BLS-PROJECTED EMPLOYMENT IN THE 40 LARGEST GROWTH OCCUPATIONS BETWEEN 1982 AND 1995
(in thousands)

Occupation	1982 Actual	1995 Projected[1]	Difference (1995-1982)	Percent Change
Guards and Doorkeepers	635	935	300	47.2
Food Preparation and Service Workers, Fast Food Restaurants	809	1106	297	36.7
Managers, Store	971	1262	291	30.0
Carpenters	863	1110	247	28.6
Electrical and Electronic Technicians	366	589	223	60.9
Licensed Practical Nurses	594	815	221	37.2
Computer Systems Analysts	254	471	217	85.4
Electrical Engineers	320	528	208	65.0
Computer Programmers	266	471	205	77.1
Maintenance Repairers, General Utility	694	887	193	27.8
Helpers, Trades	608	798	190	31.3
Receptionists	387	576	189	48.8
Electricians	542	715	173	31.9
Physicians	479	642	163	34.0
Clerical Supervisors	467	628	161	34.5
Computer Operators	211	371	160	75.8

[1]This is the moderate-trend projections which are based on assumptions and results of a moderate-growth alternative, both in terms of aggregate economic activity and industry demand patterns. In contrast, the low-trend projections are comparable to the 1973-82 period, and the high-trend projection corresponds more to that of the 1960's.

ENCLOSURE IV

BLS PROJECTED EMPLOYMENT IN THE
40 LARGEST GROWTH OCCUPATIONS
BETWEEN 1982 AND 1995
(in thousands)

Occupation	1982 Actual	1995 Projected[1]	Difference (1995-1982)	Percent Change
Sales Representatives, Nontechnical	583	743	160	27.4
Lawyers	465	624	159	34.2
Stock Clerks, Stock room and Warehouse	831	987	156	18.8
Typists	990	1145	155	15.7
Delivery and Route Workers	797	951	154	19.3
Bookkeepers, Hand	957	1109	152	15.9
Cooks, Restaurants	351	500	149	42.5
Bank Tellers[2]	471	613	142	30.1
Cooks, Short Order, Specialty and Fast Food	437	578	141	32.3

[1]These are moderate-trend projections which are based on assumptions and results of a moderate-growth alternative, both in terms of aggregate economic activity and industry demand patterns. In contrast, the low-trend projections are comparable to the 1973-1982 period, and the high-trend projection corresponds more to that of the 1960's period.

[2]Does not include new account tellers.

ENCLOSURE V

CATEGORIZATION OF DOCUMENTS RETAINED BY BLS FOR THE DURABLE GOODS INDUSTRIES

Industry	Special Studies	OP&T[1] Studies	Other Studies
Ordnance	-	-	-
Complete Guided Missiles and Space Vehicles	X	X	-
Logging	-	-	-
Sawmills and Planing Mills	-	-	-
Other Millwork, Plywood and Wood Products	-	-	-
Wooden Containers	-	-	-
Household Furniture	-	-	-
Furniture and Fixtures (Except Household)	-	-	-
Glass	-	-	-
Cement and Concrete Products	-	X	-
Structural Clay Products	-	-	-
Pottery and Related Products	-	-	-
Other Stone and Clay Products	-	-	-
Blast Furnaces and Basic Steel Products	-	X	X
Iron and Steel Foundries and Forgings	-	X	X

[1]BLS Office of Productivity and Technology.

ENCLOSURE V

CATEGORIZATION OF DOCUMENTS RETAINED BY BLS FOR THE DURABLE GOODS INDUSTRIES

Industry	Special Studies	OP&T[1] Studies	Other Studies
Primary Copper and Copper Products	-	-	-
Primary Aluminum and Aluminum Products	X	-	-
Primary Nonferrous Metals and Products	X	-	-
Metal Containers	-	-	-
Heating Apparatus and Plumbing Fixtures	-	-	-
Fabricated Structural Products	-	-	-
Screw Machine Products	-	-	-
Metal Stampings	-	-	-
Cutlery, Handtools, and General Hardware	-	-	-
Other Fabricated Metal Products	-	-	-
Engines, Turbines and Generators	-	-	-
Farm Machinery	-	-	-
Construction, Mining and Oilfield Machinery	X	-	-

[1]BLS Office of Productivity and Technology.

ENCLOSURE V

CATEGORIZATION OF DOCUMENTS RETAINED BY BLS FOR THE DURABLE GOODS INDUSTRIES

Industry	Special Studies	OP&T[1] Studies	Other Studies
Material-Handling Equipment	-	-	X
Metalworking Machinery	X	X	X
Special Industry Machinery	-	-	X
General Industrial Machinery	-	-	-
Nonelectrical Machinery	-	-	-
Computers and Peripheral Equipment	X	-	-
Typewriters and Other Office Equipment	X	-	-
Service Industry Machines	-	-	-
Electrical Transmission Equipment	-	X	-
Electrical Industrial Apparatus	-	X	-
Household Appliances	-	X	-
Electric Lighting and Wiring	-	-	-
Radio and Television Receiving Sets	-	-	-
Telephone and Telegraph Apparatus	-	X	-

[1]BLS Office of Productivity and Technology.

ENCLOSURE V

CATEGORIZATION OF DOCUMENTS RETAINED BY BLS FOR THE DURABLE GOODS INDUSTRIES

Industry	Special Studies	OP&T[1] Studies	Other Studies
Radio and Communication Equipment	X	-	-
Electronic Components	X	-	-
Other Electrical Machinery and Equipment	X	-	-
Motor Vehicles	X	X	-
Aircraft	X	X	-
Ship and Boat Building and Repair	-	-	X
Railroad Equipment	-	-	-
Motorcycles, Bicycles and Parts	-	-	X
Transportation Equipment	-	-	-
Scientific and Controlling Instruments	-	-	-
Medical and Dental Instruments	-	-	-
Optical and Ophthalmic Equipment	X	-	-
Photographic Equipment and Supplies	X	-	-

[1]BLS Office of Productivity and Technology.

ENCLOSURE V

CATEGORIZATION OF DOCUMENTS RETAINED BY BLS DURABLE GOODS INDUSTRIES

Industry	Special Studies	OP&T[1] Studies	Other Studies
Watches, Clocks and Clock-Operated Devices	-	-	-
Jewelry and Silverware	-	-	X
Musical Instruments and Sporting Goods	-	-	X
Other Manufactured Products	-	-	-
Documentation	14	11	9
No Documentation	45	48	50
Total	59	59	59

[1]BLS Office of Productivity and Technology.

ENCLOSURE VI

CATEGORIZATION OF DOCUMENTS RETAINED BY BLS FOR THE 40 LARGEST GROWTH OCCUPATIONS

Occupation	Technical Memoranda	Interviews	Trade Journals	Periodicals	Other Material
Building Custodians	X	X	X	X	X
Cashiers	X	X	X	X	X
Secretaries	X	X	X	X	X
General Clerks, Office	-	-	-	-	-
Sales Clerks	X	X	X	X	X
Nurses, Registered	X	X	X	X	X
Waiters and Waitresses	X	X	X	X	X
Kindergarten and Elementary School Teachers	X	X	X	X	X
Truck Drivers	X	X	X	X	X
Nursing Aides, Orderlies and Attendants	X	X	X	X	X
Sales Representatives, Technical	X	X	X	X	X
Accountants and Auditors	X	X	X	X	X
Automotive Mechanics	X	X	X	X	X
Blue Collar Workers Supervisors	X	X	X	X	X
Kitchen Helpers	-	-	-	-	-

ENCLOSURE VI

CATEGORIZATION OF DOCUMENTS RETAINED BY BLS FOR THE 40 LARGEST GROWTH OCCUPATIONS

Occupation	Technical Memoranda	Interviews	Trade Journals	Periodicals	Other Materials
Guards and Doorkeepers	X	X	X	X	X
Food Preparation and Service Workers, Fast Food Restaurants	-	-	-	-	-
Managers, Store	-	-	-	-	-
Carpenters	X	X	X	X	X
Electrical and Electronic Technicians	X	X	X	X	X
Licensed Practical Nurses	X	X	X	X	X
Computer Systems Analysts	X	X	X	X	X
Electrical Engineers	X	X	X	X	X
Computer Programmers	X	X	X	X	X
Maintenance Repairers, General Utility	-	-	-	-	-
Helpers, Trades	X	X	X	X	X
Receptionists	X	X	X	X	X
Electricians	X	X	X	X	X
Physicians	X	X	X	X	X
Clerical Supervisors	-	-	-	-	-
Computer Operators	X	X	X	X	X

ENCLOSURE VI

CATEGORIZATION OF DOCUMENTS RETAINED BY BLS FOR THE 40 LARGEST GROWTH OCCUPATIONS

Occupation	Technical Memoranda	Interviews	Trade Journals	Periodicals	Other Material
Sales Representatives, Nontechnical	X	X	X	X	X
Lawyers	X	X	X	X	X
Stock Clerks, Stock room and Warehouse	-	-	-	-	-
Typists	X	X	X	X	X
Delivery and Route Workers	X	X	X	X	X
Bookkeepers, Hand	X	X	X	X	X
Cooks, Restaurants	X	X	X	X	X
Bank Tellers	X	X	X	X	X
Cooks, Short Order, Specialty and Fast Food	X	X	X	X	X
Documentation	33	33	33	33	33
No Documentation	7	7	7	7	7
Total	40	40	40	40	40

ENCLOSURE VII

U.S. Department of Labor

Commissioner for
Bureau of Labor Statistics
Washington, D.C. 20212

Centennial
of Labor
Statistics

DEC 21 1984

Mr. Richard L. Fogel
Director
Human Resources Division
U.S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Fogel:

This is in response to your letter of November 26, to Under Secretary Ford B. Ford, requesting review and comment on the draft of a proposed report on "Assumptions Dealing with Technological Change used by the Bureau of Labor Statistics in Generating its 1995 Employment Projections: GAO/OCE-85-2." We have read with care the report that your staff has prepared on the BLS projection program and have both general comments and some that are very specific. To summarize our general comments:

1. One of our major concerns is that readers of this report may not appreciate the fact that technological change is accounted for in the development of projections by BLS in a number of explicit ways. Because the report focuses so heavily on the very detailed assumptions for individual occupations and industries it may leave the false impression that this is the only way technological change is reflected in the BLS projections. For example, the discussion of truckdrivers presents assumptions concerning the impact of technological innovations in warehouse operations, computer routing systems, and materials handling on employment of truckdrivers. The discussion, however, does not indicate that many other technological assumptions encompassed in our projections are also expected to affect truckdriver employment. For example, the many changes made in input-output coefficients that are expected to affect the allocation of employment between rail, air, and truck transportation and thereby to affect employment of truckdrivers are not discussed. Readers, therefore, should be informed that the technological changes listed in the report as affecting occupations focus only on the direct impacts of technological change. They do not account for all of the other ways in which technological change may affect the level of an occupation's employment which are incorporated in other elements in the BLS Projection System.

BEST COPY AVAILABLE

ENCLOSURE VII

DEC 21 1984

2. Similarly, the detailed assumptions identified for the durable goods industries represent only one avenue through which technological change can affect employment. The productivity functions used in our model, for example, embody historical rates of technological change so that, even in the absence of specific assumptions, technological change has a major impact on employment. Specific assumptions on technology do play a role in accelerating or decelerating trends, but they represent only a portion of the projected impact of technology on employment.

3. Another impression that a reader may get from a reading of the report, because terms are used like "high" or "low," "faster" or "slower," or "greater" or "less," is that descriptions of the magnitude of change for variables such as input-output coefficients are only developed in a general manner. As a consequence, the impression may be left that we are casual in suggesting orders of magnitude when exactly the opposite is true--we are very specific. In the preparation of projections at the Bureau of Labor Statistics, changes in the input-output coefficient as well as a multitude of other factors in the projection process are quantified. This is not, however, to say that considerable judgment is not involved in specifying the magnitude of change because, in spite of the fact that much material is reviewed and some sophisticated models are used, judgment about the impact of technological change is an important element of the projection process.

4. Another general comment concerns the framing of the question with respect to rate of dispersal of technology. In many cases the report states that no specific assumptions were made about the rate of dispersal of technology. To make assumptions on dispersal rates for each technology it would be necessary to conduct in-depth studies of very detailed technologies. However, the industries included in our model contain in aggregate hundreds of technologies. For example, the industry sector "general industrial machinery" alone includes the production of some types of robotic equipment in addition to many other types of machinery. We simply do not have the staff time and resources to analyze technology dispersal at that level of detail and furthermore, we are not convinced that our projections would be more accurate if we did so. In addition, there are many cases where an

ENCLOSURE VII

Mr. Richard L. Fogel--3

DEC 21 1984

explicit assumption of no major technological change was reported to the GAO staff and where, therefore, responses to the questions on rates of development and dispersal are not applicable. However, this is described in the report as "no rate provided to us," giving an incorrect impression. At the very least this practice fails to distinguish other cases where technological assumptions were made but not accompanied by assumptions concerning development or dispersal.

5. Increased use of CAD/CAM and electronics was stated as a "general" technological assumption affecting industries broadly, in the absence of other specific assumptions. This has been interpreted as applying to all industries even where more specific assumptions are directly contradictory. For example, in the furniture industry an assumption of essentially stagnant technology was made and reported. However, in the report this situation is usually reported, we think incorrectly, as meaning that no assumption was made. Still the two "general" phrases on CAD/CAM and electronics were added. This leads to the incorrect and misleading comment on page 10 that 118 of the 183 technological assumptions are those on CAD/CAM and electronics, i.e., 2 assumptions times 59 industries.

Beyond these general comments, we have a large number of suggested modifications in the report that we have directly incorporated into the attached draft for your consideration in preparing the final report. We appreciate very much the concern your staff has taken to prepare an unbiased report.

Sincerely yours,

Janet L Norwood

JANET L. NORWOOD
Commissioner

Enclosure

ENCLOSURE VIII

BERKLEY BEDELL, Iowa
CHAIRMAN

NORMAN SISISKY, VA.
JIM COOPER, TENN.
JAMES R. "JIM" OLIN, VA.
RICHARD RAY, GA.
JOSEPH P. ADDABBO, N.Y.
HENRY B. GONZALEZ, TEX.
"OBIN BRITT, N.C.

SILVIO O. CONTE, MASS.
SHERWOOD L. BOEHLERT, N.Y.
MICHAEL DIAMOND, FLA.
DAN SCHAEFER, COLO.

MAJORITY SUBCOMMITTEE STAFF
MARK J. LEVINE
CHARLES W. McMILLION
202-226-9944

MINORITY SUBCOMMITTEE COUNSEL
DONALD C. BERNO
202-226-3420

United States House of Representatives
Committee on Small Business
Subcommittee on General Oversight and the Economy
B-363 Rayburn House Office Building
Washington, D.C. 20515

December 16, 1983

The Honorable Charles A. Bowsher
Comptroller General of the United States
United States General Accounting Office
441 G Street N.W.
Washington, D.C. 20548

Dear Mr. Bowsher:

As I believe you know, Charles McMillion of my subcommittee and I have met with your Economic and Program staff since last May to discuss GAO assistance in our work on occupational projections. It is my belief that the accelerating pace and broad scope of technological change has made occupational forecasting increasingly difficult as it becomes even more vital to our economic future.

BLS occupational forecasts are the basis for virtually all other such forecasts and they figure significantly in a wide range of public policy considerations. Because of the importance of the BLS analysis Dr. McMillion and I, with your staff and others, have devoted considerable time to understanding the complex BLS employment projections system. (see attachment A)

There appears to be significantly differential treatment among industries and occupations of historic input/output coefficients and staffing pattern ratios. Certainly new technology and more efficient managerial practices can be expected to result in changes in relative industry demand for labor, and in the types of labor. But how does the BLS determine differential change in productivity growth between industries and job growth between occupations?

I would request the GAO to explicate the methodology by which the BLS arrives at adjustments to industry input/output coefficients and staffing pattern ratios. That is, that you explain the rationale for any and all adjustments to base line projections within both the Labor Demand Model and the Occupational Demand Model. I suggest that the universe be limited to durable goods industries and to the 40 occupations (attachment B) expected to provide the largest job growth to 1995.

This project is already several months beyond the timetable we agreed to with you staff. I believe that it is a most important project and I or Dr. McMillion are available to work with your staff to facilitate its rapid completion.

Sincerely,

Berkley Bedell

Attachments: Copy to Arthur J. Corazzini